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A MONOGRAPHIC STUDY OF THE NORTH AMERICAN SPECIES OF THE GENUS *BALLANA*^{1, 2} (HOMOPTERA: CICADELLIDAE)

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In 1936 many species of North American leafhoppers which had previously been described in the genus *Thamnotettix* were placed in several new genera which were described at that time by Dr. E. D. Ball and the writer. Among these was the genus *Ballana* DeLong.

When the genus was described, some 18 previously described species were placed in it and *Thamnotettix vetula* Ball was designated as the genotype. In 1937 the writer described 52 additional species, one of which, *B. gruis*, has proven to be a synonym of *B. vesca* Ball. Another 47 species are described as new in the present treatment.

The genus is related to *Gliridonus* Ball but the species are more robust, with broader heads. The crown may be broad and bluntly angled as in *B. viriosa* or it may be long and rather pointed as in *B. vastula*. The forewings are usually broad and the apical cells are short. The male aedeagus is long, narrow, flat and strap-like with teeth occurring on one edge, while the opposite edge is usually smooth. The side which bears teeth will vary according to the species and apparently, at times, within a species. The male ninth segment bears two pairs of spines on the dorsal surface. These are referred to as the anterior and posterior spines and either or both pairs may be single or bifurcate.

At the time the genus was described two subgenera were also designated. One of these, the subgenus *Laterana*, contains species with a broad, flat crown which is bluntly angled with the front. The anterior margin is produced and broadly bluntly angled. Some 15 described species are placed in this subgenus.

The species placed in the subgenus *Viriosana* have a crown which is more rounded, not flattened, and is broadly rounded to the front.

The following species descriptions are arranged according to this grouping.

The structures used for the separation of species are: the male plates, type and length, the relative length of the male styles, and the type, position size, and arrangement of the two pairs of pygofer spines. Often the position of their origin, or attachment to the pygofer is an excellent character for separation of two or more species. Although the aedeagi have been studied and illustrations prepared for many species, they are not being used for the separation of species in the present study. The seventh sternum of the female offers good characters for the separation of a few species, but for the most part only groups of species can be separated by this or other known structures.

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There is no doubt that mutations are taking place in abundance and probably rapidly in this group and these could easily be mistaken for specific characters. For that reason series of specimens have been studied in the majority of the species and a combination of characters have been used in most cases for specific designation.

A few species have distinct color markings which will assist in separating them. Most of the species of the group are pale green or yellow without markings. A few species are dimorphic in color with the male green and the female brown. Both sexes are brown in a few species.

All available material has been used for this study. The chief sources of material were the collections of the U. S. National Museum; the University of Kansas, the personal collection of Dr. E. D. Ball, now in the National Museum; the large series of specimens collected by Drs. D. J. and J. N. Knull, and the collections made by the author. I wish to express my appreciation for the use of all of this material and especially to or for all those persons who assisted me in this study, either by the loan of material or otherwise. I am especially indebted to the late Dr. E. D. Ball and the late Dr. R. H. Beamer, to Professor J. N. Knull and Dr. D. J. Knull, Dr. Paul Oman, Dr. David Young, Dr. Oscar Cartwright, Dr. James Kramer, and Dr. George Knowlton. I am greatly indebted also to Dr. Carl O. Mohr and Mrs. Jean Lockwood Swinebroad who assisted with the illustrations.

I am also indebted to The Ohio State University Graduate School for sponsoring the initial work during 1953 to 1955 and to the National Science Foundation under whose sponsorship the work was completed.

This group of leafhoppers occurs only on desert plants in the western United States and Northern Mexico, if we may rely upon collecting records. They live upon desert plants such as *Chrysothamnus*, *Arctostaphylos*, *Gutierrezia* (brown weed), and other genera and often migrate to some of the cultivated plants. While they occur as far east as Colorado, Kansas, and South Dakota, the greater numbers seem to be distributed in Utah, Arizona, Nevada, and California.

KEY TO SPECIES OF *Ballana*

Males

- | | | |
|--------|---|--------------------|
| 1 | A conspicuous spine arising on inner margin of lateral arm between anterior and posterior spines, usually close to posterior spine (fig. 32)..... | 2 |
| 1' | No spines arising on inner margin of lateral arm between anterior and posterior spines (fig. 97)..... | 10 |
| 2 (1) | Spine on pygofer arm close or attached to base of posterior spine (fig. 31)..... | 3 |
| 2' | Spine on pygofer arm not close or attached to base of posterior spine (fig. 32).... | 9 |
| 3 (2) | Anterior spine with two processes (fig. 31)..... | 4 |
| 3' | Anterior spine composed of one process (fig. 35)..... | 5 |
| 4 (3') | Anterior spine processes long, conspicuous; spine at base of posterior processes not attached to posterior spine (fig. 31)..... | <i>dissimilata</i> |
| 4' | Anterior spine processes short, spine attached to base of posterior spine (fig. 39) | <i>tremula</i> |
| 5 (3') | Plates long, pointed, extending well beyond posterior spines (fig. 176)..... | <i>extrema</i> |
| 5' | Plates shorter, not extending beyond posterior spines (fig. 174)..... | 6 |
| 6 (5') | Plates very short, with truncated apices, extending only half the distance to posterior spines (fig. 174)..... | <i>omani</i> |
| 6' | Plates longer, extending near posterior spines (fig. 175)..... | 7 |
| 7 (6') | Plates concavely rounded to narrowed blunt apices (fig. 175)..... | <i>diversa</i> |
| 7' | Plates convexly rounded to broader rounded apices (fig. 177)..... | 8 |
| 8 (7') | Styles long, more than half the length of plates (fig. 177)..... | <i>aleta</i> |
| 8' | Styles less than half the length of plates (fig. 157)..... | <i>arma</i> |

- 9 (2') Anterior spines strongly curved inwardly, median and posterior spines heavy (fig. 37)..... *latera*
- 9' Anterior spines more slender, not curved, median spines shorter, posterior spines longer and more slender (fig. 32)..... *paridens*
- 10 (1') Posterior spines chelate, bifurcate, branched or with spur-like processes arising from main spine or near apex (spur near apex may be a pointed protrusion on inner margin) (fig. 43)..... 11
- 10' Posterior spine consisting of a single process, not bifurcate, branched or chelate (fig. 133)..... 43
- 11 (10) Posterior spines definitely cleft at apex or extending to base. The apical arms of posterior spine may be proximal or widely separated. (When branched arm is short it may resemble a spur or spine.) (fig. 43)..... 23
- 11' Posterior spines not cleft, with short spur or spine-like processes only or with pointed protrusions on inner margin near apex (fig. 104)..... 12
- 12 (11') Posterior spines with two or more short spine processes arising on anterior margin and directed inwardly or at apex (fig. 104)..... 13
- 12' Posterior spines with not more than one anterior process which may arise on any part of spine (fig. 53)..... 14
- 13 (12) Spine processes of posterior spine proximal and at apex, anterior spine single (fig. 102)..... *mana*
- 13' Spine processes of posterior spine distinctly separated, some arising near base; anterior spines with two slender processes (fig. 104)..... *antlera*
- 14 (12') Spine process, a spur, arising near apex of posterior spine (fig. 53)..... 15
- 14' Spine process, a spur, arising near middle or on more basal portion of posterior spine (fig. 76)..... 19
- 15 (14) Spur arising near base on anterior margin of posterior spine (fig. 53)..... *telora*
- 15' Spur arising near middle on anterior margin of posterior spine (fig. 76)..... 16
- 16 (15') Without anterior spines (fig. 76)..... *ornata*
- 16' With anterior spines (fig. 73)..... 17
- 17 (16') Anterior spines curved caudally and outwardly (fig. 73)..... *extera*
- 17' Anterior spines straight, extending caudally and inwardly (fig. 57)..... 18
- 18 (17') Anterior spines long, extending almost to median line of pygofer (fig. 57)..... *convergens*
- 18' Anterior spines shorter, extending only to margin of central dorsal pygofer tube (fig. 52)..... *tolara*
- 19 (14') Plates tapered and acutely pointed (fig. 229)..... 20
- 19' Plates convexly rounded or with blunt apices (fig. 259)..... 21
- 20 (19) Apical portion of posterior spine slender beyond spur (fig. 105)..... *aris*
- 20' Apical portion of posterior spine thick, rapidly tapered beyond spur on inner margin (fig. 81)..... *cerea*
- 21 (19') Plates long, broadly rounded, styles extending almost the length of plates (fig. 259)..... *dena*
- 21' Styles extending not more than half the length of plates (fig. 257)..... 22
- 22 (21') Posterior spine with a short thick spur on inner margin just before apex. Pygofer arm between anterior and posterior spines long (fig. 103)..... *seca*
- 22' Posterior spine with a short slender spur on anterior margin farther from apex. Pygofer arm between anterior and posterior spines much shorter (fig. 58)..... *profusa*
- 23 (11) Posterior spines bifid only at apex (fig. 106)..... 24
- 23' Posterior spines bifid at least half way to base; often cleft to base (fig. 154)..... 25
- 24 (23) Anterior spine with a pair of short teeth (fig. 106)..... *velosa*
- 24' Anterior spine broad, heavy, long, extending almost to posterior spines (fig. 107)..... *vespertina*
- 25 (23') Posterior spines arising from inner portion of pygofer arms near apex (fig. 43)..... 26
- 25' Posterior spines arising from terminus of pygofer arms (fig. 36)..... 28
- 26 (25) Posterior spines short, anterior arm shorter than posterior arm, anterior spine long, curved outwardly (fig. 43)..... *volsella*

- 26¹ Posterior spines longer, extending almost to middle line, anterior and posterior arms about equal in length, anterior spine shorter (fig. 153)..... 27
- 27 (26¹) Plates bluntly pointed, posterior spines cleft about half way to base (fig. 153)..... *calipera*
- 27¹ Plates more rounded at apex, posterior spines cleft more than half way to base (fig. 154)..... *bicornis*
- 28 (25¹) Anterior spines long, reaching to or surpassing posterior spines (fig. 160)..... 29
- 28¹ Anterior spines much shorter, not reaching posterior spines (fig. 151)..... 31
- 29 (28) Anterior spines very long and slender, extending much beyond posterior spines (fig. 36)..... *cuna*
- 29¹ Anterior spines much thicker, reaching to posterior spines (fig. 37)..... 30
- 30 (29¹) An inner anterior spine is directed inwardly, plates long, rapidly tapered to blunt apices, extending beyond posterior margin of pygofer (figs. 37 and 156)..... *latula*
- 30¹ Anterior spine not directed inwardly, plates shorter, broad and rounded (figs. 41 and 181)..... *densa*
- 31 (28¹) Cleft portion of dorsal spine with ventral arm shorter (fig. 148)..... 32
- 31¹ Cleft portion of dorsal spine with dorso-caudal arm shorter (fig. 82)..... 37
- 32 (31) Anterior spine composed of two small spurs (fig. 109)..... 33
- 32¹ Anterior spine composed of one spine or spur (fig. 116)..... 35
- 33 (32) Plates long and narrow, apices pointed, styles not more than one-third the length of plates (fig. 148)..... *bifida*
- 33¹ Plates blunt at apex, styles longer, one-half the length of plates (fig. 194)..... 34
- 34 (33¹) Posterior spine with dorso-caudal arm of "chela" strongly curved dorsally and outwardly (fig. 113)..... *chelata*
- 34¹ Posterior spine with dorso caudal arm of "chela" not strongly curving dorsally and outwardly (figs. 62 and 60)..... *gerula, veruta*
- 35 (32¹) Plates narrow, apices pointed, styles not more than one-third the length of plates (fig. 151)..... 36
- 35¹ Plates short, rounded, styles more than one-half the length of plates (fig. 151)..... *dira*
- 36 (35) Plates long, straight, reaching to posterior spines, styles about one-third the length of plates (fig. 232)..... *ipis*
- 36¹ Plates shorter, concave, not reaching posterior spines, styles shorter, extending about one-fourth the length of plates (fig. 266)..... *titusi*
- 37 (31¹) Anterior spine composed of two spines or tiny spurs (fig. 82)..... 38
- 37¹ Anterior spine composed of one spine or curved spur (fig. 64)..... 42
- 38 (37) Anterior spine with two tiny spurs (fig. 82)..... 39
- 38¹ Anterior spine with one longer and one shorter spur (fig. 112)..... 41
- 39 (38) Dorso caudal arm of anterior spine very short, appearing almost as a spur (fig. 82)..... *extrana*
- 39¹ Dorso caudal arm of anterior spine longer (fig. 45)..... 40
- 40 (39) Plates short and blunt, styles long, three-fourth the length of plates, posterior spine arms very short (fig. 189)..... *dupla*
- 40¹ Plates long, extending beyond posterior spines, apices bluntly pointed, styles shorter, about one-third the length of plates, posterior spine arms longer (fig. 149)..... *callida*
- 41 (38¹) Plates short, bluntly pointed, styles more than one-half the length of plates (fig. 202)..... *radiata*
- 41¹ Plates long, extending beyond posterior spines, bluntly pointed, styles shorter, not more than one-third the length of plates (fig. 150)..... *repa*
- 42 (37¹) Anterior spine long, straight, extending diagonally caudally and inwardly, plates long, bluntly pointed (fig. 64)..... *projecta*
- 42¹ Anterior spine short, thick, curved, plates short and rounded, posterior spine dorso caudal arm very short (fig. 47)..... *directa*
- 43 (10¹) Without anterior spines or basal plate for their attachment (fig. 98)..... 44
- 43¹ Anterior spines or a dark pigmented spine plate present (fig. 100)..... 45

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| 44 (43) | Posterior spines strongly curved inwardly toward anal tube, plates short, apices rounded (figs. 98 and 255)..... | <i>absenta</i> |
| 44' | Posterior spines longer, only weakly curving inwardly, produced caudally, and widely separated at anal tube. Plates longer and more pointed, styles with a shorter apical projection (figs. 99 and 261)..... | <i>lauguida</i> |
| 45 (43') | Posterior spine short and broad deeply concavely excavated on inner margin at apex, outer margin conspicuously toothed, spines produced caudally, widely separated at apex (fig. 100)..... | <i>pleura</i> |
| 45' | Posterior spines longer, not deeply excavated on inner margin tapered to inwardly, produced, pointed apices (fig. 133)..... | 46 |
| 46 (45') | Anterior spines consisting of one or two prominent projections, straight, curved or robust (fig. 135)..... | 47 |
| 46' | Anterior spines represented only by a pigmented basal plate which may bear one or two minute teeth or spurs (fig. 51)..... | 100 |
| 47 (46) | Anterior spines consisting of two prominent projections (fig. 135)..... | 48 |
| 47' | Anterior spines consisting on one prominent projection (fig. 38)..... | 57 |
| 48 (47) | Two projections of anterior spines in dorsal view, appearing crossed, one portion extending inwardly and the other projection extending caudally (fig. 135)..... | 49 |
| 48' | Two portions of anterior spine not crossed (fig. 179)..... | 52 |
| 49 (48) | Plates long, concavely tapered to pointed apices (fig. 170)..... | 50 |
| 49' | Plates more convexly rounded, apices bluntly angled (fig. 217)..... | 51 |
| 50 (49) | Styles extending half the length of plates, two branches of anterior spine about equal in length, terminus of pygofer strongly narrowed (figs. 135 and 159)..... | <i>visalia</i> |
| 50' | Styles extending one third the length of plates; posterior branch of anterior spine longer than anterior branch. Pygofer not narrowed posteriorly (figs. 133 and 170)..... | <i>adversa</i> |
| 51 (49') | Styles extending more than half the length of plates; posterior spines extending caudally either side of anal tube (figs. 61 and 217)..... | <i>youngi</i> |
| 51' | Styles extending less than one third the length of plates posterior spines extending more transversely (figs. 77 and 190)..... | <i>transea</i> |
| 52 (48') | The spines or spurs representing anterior spine, short, the dorsal or posterior may be curved (fig. 56)..... | 53 |
| 52' | The spurs of anterior spine with a short anterior branch and a long posterior branch, both extending caudad or obliquely and parallel (fig. 74)..... | 55 |
| 53 (52) | Plates broad, blunt at tips, styles extending two thirds the length of plates (fig. 179)..... | <i>ursina</i> |
| 53' | Plates narrowed to pointed apices, styles short about one fourth the length of plates (figs. 223 and 225)..... | 54 |
| 54 (53') | Posterior spines long, overlapping at median line abruptly narrowed near middle, plates convexly rounded (fig. 67)..... | <i>datuna</i> |
| 54' | Posterior spines short, tapered gradually, not extending to middle, plates concavely narrowed (fig. 79)..... | <i>curta</i> |
| 55 (52') | Plates concavely tapered to pointed apices, styles not more than one third the length of plates..... | 56 |
| 55' | Plates short, convexly rounded, styles extending two thirds the length of plates (fig. 193)..... | <i>basala</i> |
| 56 (55) | Plates long extending to posterior spines, styles extending about one third the length of plates (fig. 166)..... | <i>nigridens</i> |
| 56' | Plates short, not extending to posterior spines, styles very short, extending not more than one fifth the length of plates (fig. 204)..... | <i>delta</i> |
| 57 (47') | Anterior spines quite long either crossing the posterior spines or long, slender, extending along the dorsal portion of pygofer or curved and extending almost to posterior spines (fig. 122)..... | 58 |
| 57' | Anterior spines shorter, stout, straight, curved or diagonally directed (fig. 38).... | 65 |
| 58 (57) | Anterior spines crossing posterior spines (fig. 72)..... | 59 |

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| 58' | Anterior spines long, extending almost to posterior spines but not crossing them (fig. 123)..... | 63 |
| 59 (58) | Anterior spines long and slender or curved outwardly, crossing posterior spines near their apices (fig. 72)..... | 60 |
| 59' | Anterior spines more robust, or curved inwardly, crossing spines near base (figs. 120 and 119)..... | 62 |
| 60 (59) | Anterior spines curved outwardly, styles extending about half the length of plates (figs. 72 and 222)..... | <i>apta</i> |
| 60' | Anterior spines long, slender, styles about two thirds the length of plates (figs. 122 and 121)..... | 61 |
| 61 (60') | Plates elongate rather narrow, apices broadly rounded (fig. 207)..... | <i>attenuata</i> |
| 61' | Plates broad at base convexly rounded, apices blunt (fig. 167)..... | <i>filamentia</i> |
| 62 (59') | Anterior spines straight, robust, finely serrate on margins, styles about one fourth the length of plates (figs. 120 and 161)..... | <i>firma</i> |
| 62' | Anterior spines arising near base of posterior, not serrate, curved inwardly, styles about one half the length of plates (figs. 119 and 169)..... | <i>deleat</i> |
| 63 (58') | Anterior spines long and straight, styles about one third the length of plates (figs. 123 and 163)..... | <i>prava</i> |
| 63' | Anterior spines shorter, robust, curved outwardly, styles shorter, not more than one fourth the length of plates (figs. 118 and 178)..... | 64 |
| 64 (63') | Plates short not reaching posterior spines which are also very short (fig. 212)..... | <i>abrupta</i> |
| 64' | Plates very long, concavely tapered to pointed tips which extend beyond posterior spines; posterior spines longer and with pointed apices (figs. 118 and 178)..... | <i>vastula</i> |
| 65 (57') | Anterior spines thick, extending inwardly and bent caudally, posterior spine arm curving posteriorly and caudally, notched on inner margin just before apex (fig. 38)..... | <i>vapida</i> |
| 65' | Anterior spines more slender, not bent, spine arm otherwise, not notched on inner margin near apex (fig. 129)..... | 66 |
| 66 (65') | Anterior spines prominent or conspicuous, curving or sloping obliquely, inwardly, or with stout curved or hooked process (fig. 129)..... | 67 |
| 66' | Anterior spines small, directed caudally on dorsal surface of plate or curving or sloping inwardly (fig. 70 and 54)..... | 79 |
| 67 (66) | Anterior spines reaching posterior spines and or crossing them (fig. 129)..... | <i>chrysothamna</i> |
| 67' | Anterior spines not extending to posterior spines (fig. 83)..... | 68 |
| 68 (67') | Posterior spines long, crossing each other on median line (fig. 84)..... | 69 |
| 68' | Posterior spines may extend to median line but do not cross each other or overlap (fig. 50)..... | 71 |
| 69 (68) | Posterior spines straight, tapered apical portion crossing each other (fig. 124)..... | 70 |
| 69' | Posterior spines stout, strongly bent recurved apical portion beyond crossover much longer (fig. 83)..... | <i>chiragrica</i> |
| 70 (69) | Plates long, narrow, tapered to blunt apices, styles short, not more than one third the length of plates (fig. 200)..... | <i>remissa</i> |
| 70' | Plates broad convexly rounded, apices rounded, styles long, about two thirds the length of plates (fig. 165)..... | <i>spinosa</i> |
| 71 (68') | Posterior spines extending almost caudally, not transverse (fig. 71)..... | 72 |
| 71' | Posterior spines extending obliquely inwardly and caudally (fig. 130)..... | 73 |
| 72 (71) | Posterior and anterior spines tapered and sharply pointed, plates extending to base of anal tube (figs. 71 and 211)..... | <i>knulli</i> |
| 72' | Posterior and anterior spines blunter at apex, plates longer, extending almost to apex of anal tube (figs. 50 and 195)..... | <i>amplecta</i> |
| 73 (71') | Plates long concavely narrowed to pointed apices (fig. 164)..... | <i>coarcta</i> |
| 73' | Plates with outer margin straight or convexly rounded (fig. 201)..... | 74 |
| 74 (73') | Anterior spines long, straight, extending inwardly and caudally, almost parallel to posterior spines (fig. 127)..... | 75 |

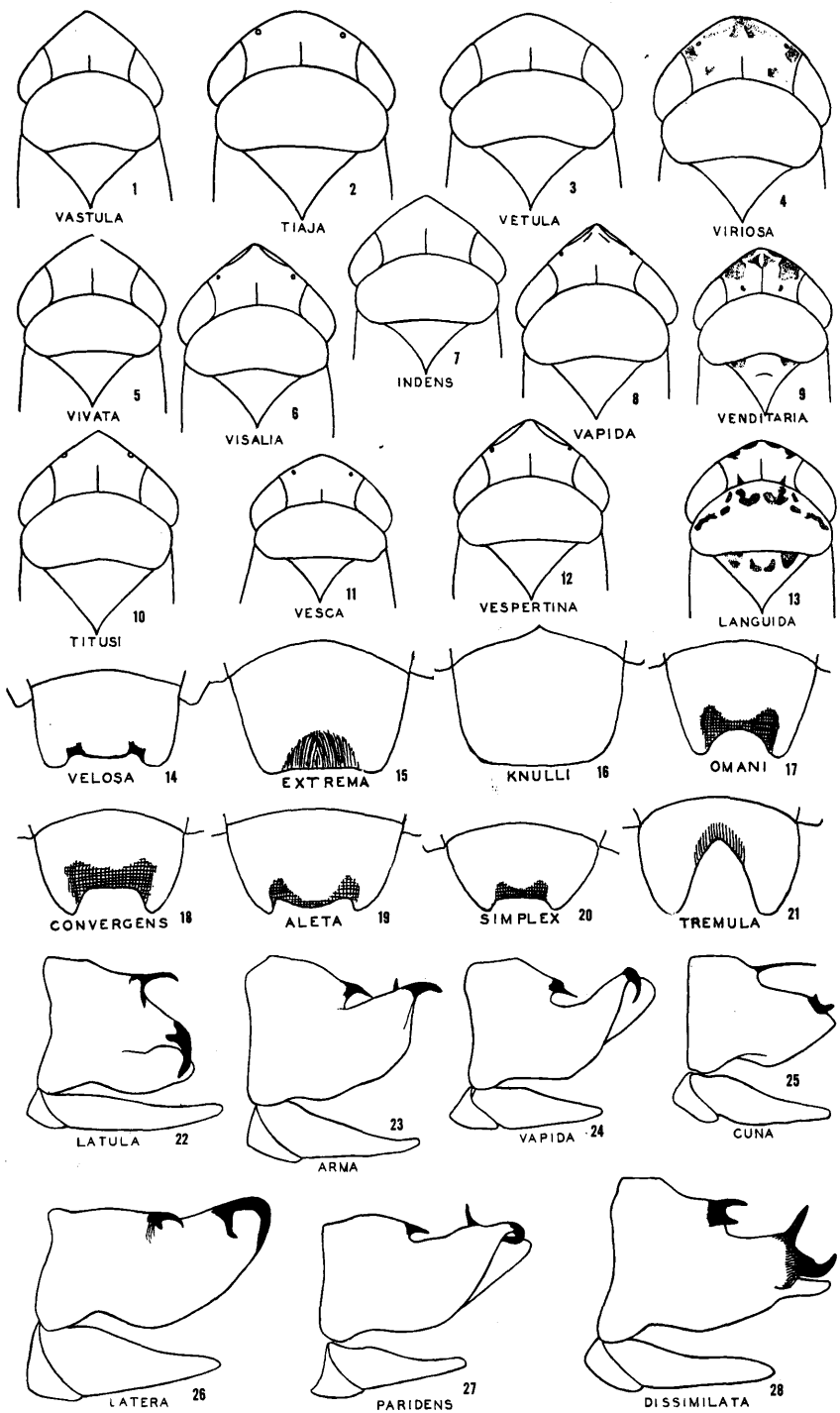
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| 74' | Anterior spines shorter, or curved, not extending parallel to posterior spines (fig. 78)..... | 76 |
| 75 (74) | Anterior spines parallel with posterior spines, styles about one half the length of plates (figs. 127 and 201)..... | <i>parallela</i> |
| 75' | Posterior spines slightly curved, especially at base, spines not parallel, styles about one fourth the length of plates (figs. 128 and 173)..... | <i>quira</i> |
| 76 (74') | Styles extending about one half the length of plates (fig. 184)..... | 77 |
| 76' | Styles extending about one fourth the length of plates (fig. 196)..... | <i>atela</i> |
| 77 (76) | Plates short, round, not reaching base of posterior spines by one half their length (fig. 184)..... | <i>clara</i> |
| 77' | Plates longer, reaching to base of posterior spines (fig. 183)..... | 78 |
| 78 (77') | Anterior spines robust to apex, plates bluntly pointed at apex (figs. 126 and 183)..... | <i>polica</i> |
| 78 | Anterior spines slender on apical half, plates acutely pointed (figs. 75 and 213)..... | <i>orleta</i> |
| 79 (66') | Posterior spines very short, extending caudally, not approximating the central dorsal pygofer (fig. 70)..... | <i>delicata</i> |
| 79' | Posterior spines transverse or extending obliquely caudally (fig. 54)..... | 80 |
| 80 (79') | Posterior spines arising from pygofer arm or with an abrupt angle where they join the pygofer arm (fig. 54)..... | 81 |
| 80' | Posterior spines arising at terminus of pygofer arm, or pygofer arm curving to form the spine (fig. 66)..... | 86 |
| 81 (80) | Posterior spines arising from side of pygofer arm (fig. 54)..... | <i>undata</i> |
| 81' | Posterior spines arising at an angle from the terminus of pygofer arm (fig. 142).... | 82 |
| 82 (81') | Plates short, broader at base than long, considerably shorter than pygofer, not reaching posterior spines (fig. 238)..... | <i>indens</i> |
| 82' | Plates longer, as long as combined basal width, as long as pygofer or almost reaching posterior spines (fig. 234)..... | 83 |
| 83 (82') | Styles extending one half the length of plates (fig. 226)..... | 84 |
| 83' | Styles not more than one third the length of plates (fig. 182)..... | 85 |
| 84 (83) | Plates convexly curving to bluntly pointed apices, posterior spines straight, extending diagonally caudally, not extending to anal tube (figs. 137 and 234)..... | <i>sera</i> |
| 84' | Plates concavely rounded to broad rounded apices, posterior spines recurved, apical portion transverse, apices extending to median line (figs. 87 and 226)..... | <i>mira</i> |
| 85 (83') | Plates concavely tapered to slender pointed apices (fig. 182)..... | <i>defecta</i> |
| 85' | Plates broader, sides straight, apices blunt (fig. 224)..... | <i>angula</i> |
| 86 (80') | Plates concavely rounded on outer margin (fig. 224)..... | 87 |
| 86' | Plates straight or convexly rounded on outer margin (fig. 203)..... | 90 |
| 87 (86) | Plates broad or blunt at apex (fig. 224)..... | 88 |
| 87' | Plates with narrow pointed apices (fig. 221)..... | 89 |
| 88 (87) | Posterior spines extending transversely to median line, styles half as long as plates (figs. 66 and 224)..... | <i>simplex</i> |
| 88' | Posterior spines extending obliquely caudally to length of anal tube, but widely separated, styles about one third the length of plates (figs. 139 and 235)..... | <i>viriosa</i> |
| 89 (87') | Posterior spines gradually tapered from base to pointed apices, plates short (figs. 44 and 221)..... | <i>rara</i> |
| 89' | Posterior spines enlarged near base, then rapidly tapered to pointed apices, plates long, extending to base of anal tube (figs. 131 and 230)..... | <i>vivata</i> |
| 90 (86') | Styles extending more than half the length of plates (fig. 203)..... | 91 |
| 90' | Styles extending less than half the length of plates (fig. 187 and 242)..... | 92 |
| 91 (90) | Plates short, broadly rounded, not extending to base of posterior spines, posterior spines transverse on apical portion, overlapping (figs. 48 and 203)..... | <i>curvata</i> |
| 91' | Plates long, convexly rounded to broad blunt apices which reach tip of posterior spines; posterior spines obliquely sloping reaching median line at anal tube (figs. 143 and 240)..... | <i>diutia</i> |
| 92 (90') | Posterior spines long, transverse, or curving and overlapping at middle, or extending to median line of pygofer (fig. 63)..... | 93 |

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| 92' | Posterior spines short or curving, not extending to median line (fig. 141)..... | 97 |
| 93 (92) | Plates long, tapered to blunt apices extending beyond posterior spines (fig. 187).... | 94 |
| 93' | Plates shorter not reaching beyond base of posterior spines (fig. 215)..... | 95 |
| 94 (93) | Ventral spine, a small caudally sloping spur, appearing to arise from base of posterior spine; styles one fourth the length of plates (fig. 55 and 187)..... | <i>flexa</i> |
| 94' | Ventral spine robust, curved inwardly not connected with posterior spine; styles longer, about one third the length of plates (figs. 145 and 242)..... | <i>recurvata</i> |
| 95 (93') | Plates shorter not extending to base of posterior spines, apices sharply, acutely angled (fig. 215)..... | <i>fatuita</i> |
| 95' | Plates extending to base of posterior spines apices bluntly angled (fig. 239)..... | 96 |
| 96 (95') | Anterior spines hooked, posterior spines long, transverse, straight, styles extending not more than one third the length of plates (figs. 144 and 239)..... | <i>hama</i> |
| 96' | Anterior spine smaller, curved caudally, posterior spines curved, apices more slender, styles longer, almost half the length of plates (figs. 86 and 214)..... | <i>effusa</i> |
| 97 (92') | Plates broad, broadly convexly rounded, apices broad, rounded (fig. 247)..... | <i>atr dorsum</i> |
| 97' | Plates more narrowed, tapered to bluntly angled apices (fig. 241)..... | 98 |
| 98 (97') | Posterior spines extending caudally and inwardly, not reaching anal tube (fig. 141) | <i>vesca</i> |
| 98' | Posterior spines curving anteriorly (fig. 136)..... | 99 |
| 99 (98) | Posterior spines short, apices not approaching median line of pygofer (fig. 138) | <i>venditaria</i> |
| 99' | Posterior spines long, curving anteriorly and inwardly almost to median line, apices curved outwardly (fig. 136)..... | <i>curvidens</i> |
| 100 (46') | Plates short, not extending to base of posterior spines (fig. 51)..... | 101 |
| 100' | Plates extending to base of or beyond posterior spines (fig. 190)..... | 108 |
| 101 (100) | Styles at least one half the length of plates (fig. 51)..... | 102 |
| 101' | Styles not more than one third the length of plates (fig. 185)..... | 106 |
| 102 (101) | Posterior spines not extending to median line (fig. 93)..... | 103 |
| 102' | Posterior spines overlapping at median line (fig. 51)..... | <i>dola</i> |
| 103 (102) | Posterior spines very short, extending about half the distance to anal tube (fig. 93)..... | <i>vetula</i> |
| 103' | Posterior spines longer, extending onto dorsal pygofer or almost to anal tube (fig. 147)..... | 104 |
| 104 (103') | Posterior spines with apical portion transverse, plates short and broad (figs. 147 and 256)..... | <i>mera</i> |
| 104' | Posterior spines sloping obliquely, caudally, plates more narrowed (figs. 97 and 253)..... | 105 |
| 105 (104') | Posterior spines stout at base reaching almost to anal tube, pygofer much longer than plates (figs. 97 and 253)..... | <i>calcara</i> |
| 105' | Posterior spines shorter, more slender, plates more narrowed at apex (figs. 91 and 248)..... | <i>occidentalis</i> |
| 106 (101') | Plates short with broad rounded apices (fig. 185)..... | <i>letura</i> |
| 106' | Plates concavely narrowed, apices blunt or pointed (fig. 205)..... | 107 |
| 107 (106') | Plates tapered to pointed apices, posterior spines curved and overlapping at middle (figs. 49 and 205)..... | <i>arcuata</i> |
| 107' | Plates bluntly angled, posterior spines stout, curved, angled with pygofer arm and abruptly tapered at apex (figs. 146 and 243)..... | <i>valga</i> |
| 108 (100') | Plates extending beyond posterior spines (fig. 190)..... | 109 |
| 108' | Plates not extending beyond posterior spines (fig. 251)..... | 112 |
| 109 (108) | Posterior spine transverse, styles two thirds as long as plates (figs. 77 and 190) | <i>traversa</i> |
| 109' | Posterior spines extending obliquely caudally, styles not exceeding one half the length of plates (figs. 96 and 254)..... | 110 |
| 110 (109') | Posterior spines long, extending to base of anal tube (fig. 96)..... | <i>elixa</i> |
| 110' | Posterior spines shorter not extending to anal tube (fig. 89)..... | 111 |

| | | |
|------------|---|------------------|
| 111 (110') | Styles about one half the length of plates, posterior spines sloping to caudal end of dorsal pygofer tube (figs. 89 and 246)..... | <i>brevidens</i> |
| 111' | Styles shorter, about one third the length of plates, dorsal spines extending onto dorsal pygofer tube (figs. 88 and 245)..... | <i>hebea</i> |
| 112 (108') | Styles short, not more than one third the length of plates (fig. 251)..... | 113 |
| 112' | Styles longer, one half or more the length of plates (fig. 188)..... | 114 |
| 113 (112) | Plates short with blunt apices, posterior spines widely separated at anal tube (figs. 95 and 251)..... | <i>tiaja</i> |
| 113' | Plates with pointed apices, posterior spines almost reaching anal tube (figs. 90 and 237)..... | <i>calcea</i> |
| 114 (112') | Posterior spines crossing each other or overlapping at median line of pygofer (fig. 69)..... | 115 |
| 114' | Posterior spines not crossing at middle (fig. 92)..... | 116 |
| 115 (114) | Posterior spines crossing at middle, styles extending more than half the length of plates (figs. 69 and 188)..... | <i>luxuria</i> |
| 115' | Posterior spines transverse, overlapping, styles less than half the length of plates (figs. 85 and 220)..... | <i>insula</i> |
| 116 (114') | Plates rounded to pointed apices, styles about two thirds the length of plates (figs. 92 and 249)..... | <i>plena</i> |
| 116' | Plate bluntly angled at apex, styles about one half the length of plates (figs. 101 and 262)..... | 117 |
| 117 (116') | Pygofer narrowed, plates and styles longer (figs. 101 and 262)..... | <i>aperta</i> |
| 117' | Pygofer widened, posterior spines more robust (figs. 94 and 250)..... | <i>ortha</i> |

Females

| | | |
|---------|---|---|
| 1 | Posterior margin of seventh sternum produced, truncate or trilobate..... | 2 |
| 1' | Posterior margin of seventh sternum with some type of definite excavation..... | 6 |
| 2 (1') | Posterior margin broadly roundedly produced (figs. 372 and 16)..... | <i>amplecta, knulli</i> |
| 2' | Posterior margin truncate or trilobate..... | 3 |
| 3 (2') | Posterior margin truncate (figs. 371, 396, 400, 382, and 366) <i>adversa, extrema, languida, vastula, vesca</i> | |
| 3' | Posterior margin notched, forming three lobes which are produced to about the same length..... | 4 |
| 4 (3') | Distinctly trilobate..... | 5 |
| 4' | Slightly trilobate (figs. 380, 395, 376, 393, 392, and 368) <i>abrupta, curta, datuna, ornata, rara, repa</i> | |
| 5 (4') | Central lobe produced (fig. 337)..... | <i>ortha</i> |
| 5' | Central lobe not produced (figs. 344, 367, 348, 341, 359, 340, and 329) <i>calcea, curvidens, elexa, hebea, mera, pleura, quira</i> | |
| 6 (1') | Posterior margin roundedly excavated..... | 7 |
| 6' | Posterior margin more abruptly excavated or notched, the corners of excavation angled or distinct, the posterior margin of excavation produced truncate, or notched..... | 15 |
| 7 (6') | Posterior margin shallowly roundedly excavated..... | 8 |
| 7' | Posterior margin deeply roundedly excavated..... | 9 |
| 8 (7') | Excavation narrow or very shallow (figs. 333, 387, 360, 346, 388, 351, 365, 334, and 394)..... | <i>absenta, atela, cuna, atridorsum, extrana, hama, titusi, valga, vetula</i> |
| 8' | Excavation distinctly but not deeply excavated, less than one-fourth the distance to base (figs. 383, 352, 343, 377, 361, 374, 381, 17, 397, 401, 20, 398, 406, 338, and 402) <i>arcuata, aris, brevidens, dola, firma, gerula, indens, omani, projecta, remissa, simplex, vespertina, viriosa, vivata, youngi</i> | |
| 9 (7') | Excavation broad, extending one-third the distance to base (fig. 354)..... | <i>arma</i> |
| 9' | Excavation more narrowed broadly U-shaped or V-shaped and extending more than one-third distance to base..... | 10 |
| 10 (9') | Excavation broadly v-shaped..... | 11 |



the distance to base. The posterior margin of excavation convexly rounded. Male plates strongly, convexly rounded to broad rounded apices. Styles medium in length, extending to about half the length of plates. Anterior spines represented by a pair of short, thick, proximal spurs on each side. Posterior spines long, thick, apices reaching anal tube and with a slight apical spur on anterior margin. A short thick diagonal spur arises at base.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens from Colfax, California. Other specimens examined are from Stinson Beach and Ione, California.

Ballana ursina (Ball)

(Figs. 56 and 179)

Thamnotettix ursina Ball, 1910: 307.

A large brown species with a pointed head and distinct male genital structures. Length: 6.5 to 7 mm.

Crown produced and pointed, more than half as long as basal width.

Color.—Crown and scutellum pale brown or buff, pronotum and forewings darker brown tinted with yellow. Forewings with flecks of yellow.

Genitalia.—Female seventh sternum with produced rounded lateral angles, between which the posterior margin is broadly, abruptly excavated on the median half, about one-fifth the distance to base. Posterior margin of excavation truncate. Male plates convexly rounded to a broad apex which is blunt, angled, the tips divergent. Styles long, extending more than half the length of plates. Anterior spines short, extending inwardly, the apex a recurved hook. Posterior spines extending caudally and sloping inwardly, the tips crossing each other near anal tube.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from a pair of specimens collected at Medford, Oregon.

Ballana arma DeLong

(Figs. 23, 30, 157, and 354)

Ballana arma DeLong, 1937: 123.

In coloration resembling *dissimilata* but smaller, with blunter crown and with distinct genitalia. Length: 6.5 to 7 mm.

Crown broad, scarcely produced, bluntly angled, about one-half wider between eyes at base than length at middle.

Color.—Male green, female brown. In both sexes the crown is yellowish with reflexed arcs of face visible on margin from above. In male, pronotum green with yellowish anterior margin, forewings green with paler veins. Female pronotum brown with paler margin, forewings dark brown with paler veins.

Genitalia.—Female seventh sternum only two-thirds as wide at base as previous segment, gradually narrowed to posterior margin which is broadly rather shallowly excavated between prominent angles. Male plates not quite as long as combined basal width, sides concavely rounded at middle, apices rather broad, bluntly rounded, not reaching posterior spines by half their length. Styles medium in length, extending about one-third the length of plates. Anterior spines rather short, heavy, directed caudally. Posterior spines heavy with a conspicuous caudal spur at base, the spine proper extending caudally and inwardly toward, but not reaching, anal tube.

Type.—Ball collection, U. S. National Museum.

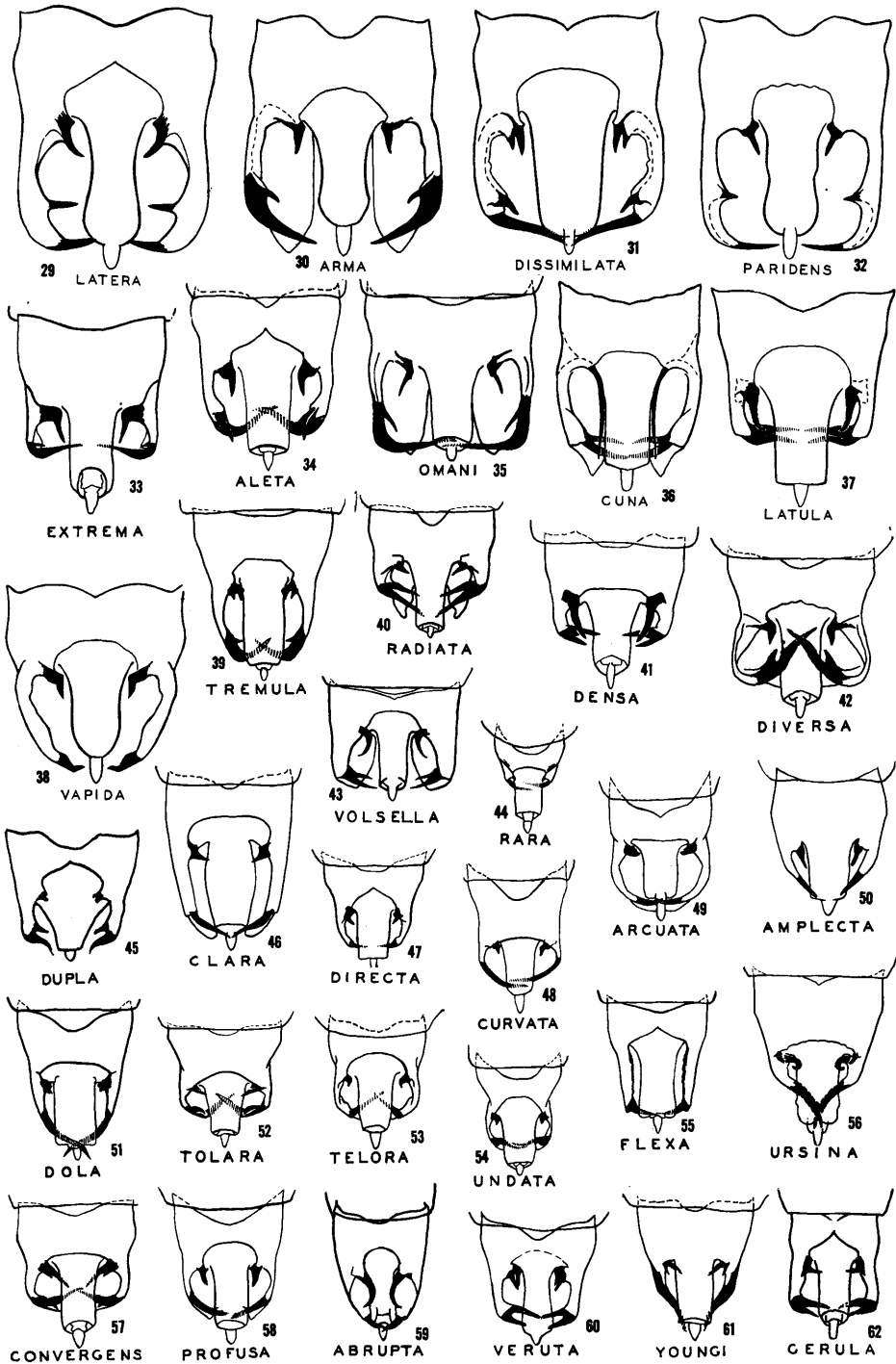
Remarks.—Described from specimens collected at Yarnell Heights, Arizona. Other specimens examined are from Lompoc, California; San Jacinto Mts., Hualpai, and Oak Creek Canyon, Arizona.

Ballana paridens DeLong

(Figs. 27, 32, 158 and 363)

Ballana paridens DeLong, 1937: 123.

Resembling *vapida* in appearance and coloration but with distinct genitalia. Length: 6 mm.



FIGURES 29-62. Dorsal view of apical portion of male abdomen, illustrating position and type of spines, of species as labeled.

Crown produced but bluntly angled, about one and two-thirds times as wide between eyes at base as length at middle.

Color.—Brownish tinged with yellow, face with a series of conspicuous arcs broken at middle. Crown pale brownish, reflexed arcs of face usually visible on margin from above. A pair of faint spots just above apex and a longitudinal stripe on disc either side, darker. Pronotum dark brown, paler on anterior margin. Forewings dark brown irrorate with yellow, veins yellow.

Genitalia.—Female seventh sternum narrowed at base, lateral margins produced to posterior margin which is broadly, rather shallowly but squarely excavated and heavily black margined. Male plates about as long as combined basal width, sides concavely rounded. Apices rather broad, rounded, not reaching posterior spines by more than one-third their length. Styles medium in length, reaching about one-third the length of plates. Anterior spines medium in length, thick at base with the long apical spur pointing caudally and inwardly. Pygofer arm with a spine directed inwardly, half way between anterior and posterior spines. Posterior spines transverse, single, slender, not extending to anal tube.

Type.—Ball collection. U. S. National Museum.

Remarks.—Described from specimens collected at Pine Valley, California. Specimens have also been examined from Ione, Bowman, Jacumba, and Mt. St. Helena, California; Granite Dell, Huachuca Mt., and Prescott National Forest, Arizona.

Ballana latera DeLong

(Figs. 26, 29, and 168)

Ballana latera DeLong, 1937: 123.

In form and appearance resembling *dissimilata* but with distinct genitalia. Length: 6.5 mm.

Crown bluntly angled, more than one and one-half times as wide between eyes at base as median length. Margin acutely angled with front.

Color.—Crown tawny, ocelli black, recurved arcs from front visible from above on margin of crown. Pronotum, scutellum and forewings dull greenish, washed with yellow, veins yellowish.

Genitalia.—Male plates about as long as combined basal width, sides slightly concave at middle, apices broad, almost truncate, sloping to inner angled margin, not reaching posterior spines by at least one-third their length. Styles medium in length, not reaching to middle of plates. Anterior spines medium in length, heavy, curved caudally and inwardly. A pair of medium length spines extend inwardly from pygofer arm half way between anterior and posterior spines. Posterior spines transverse, short, heavy, single, extending to dorsal pygofer.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from a male specimen collected at Santa Margarita, California.

Ballana vapida (Ball)

(Figs. 8, 24, 38, 152, and 409)

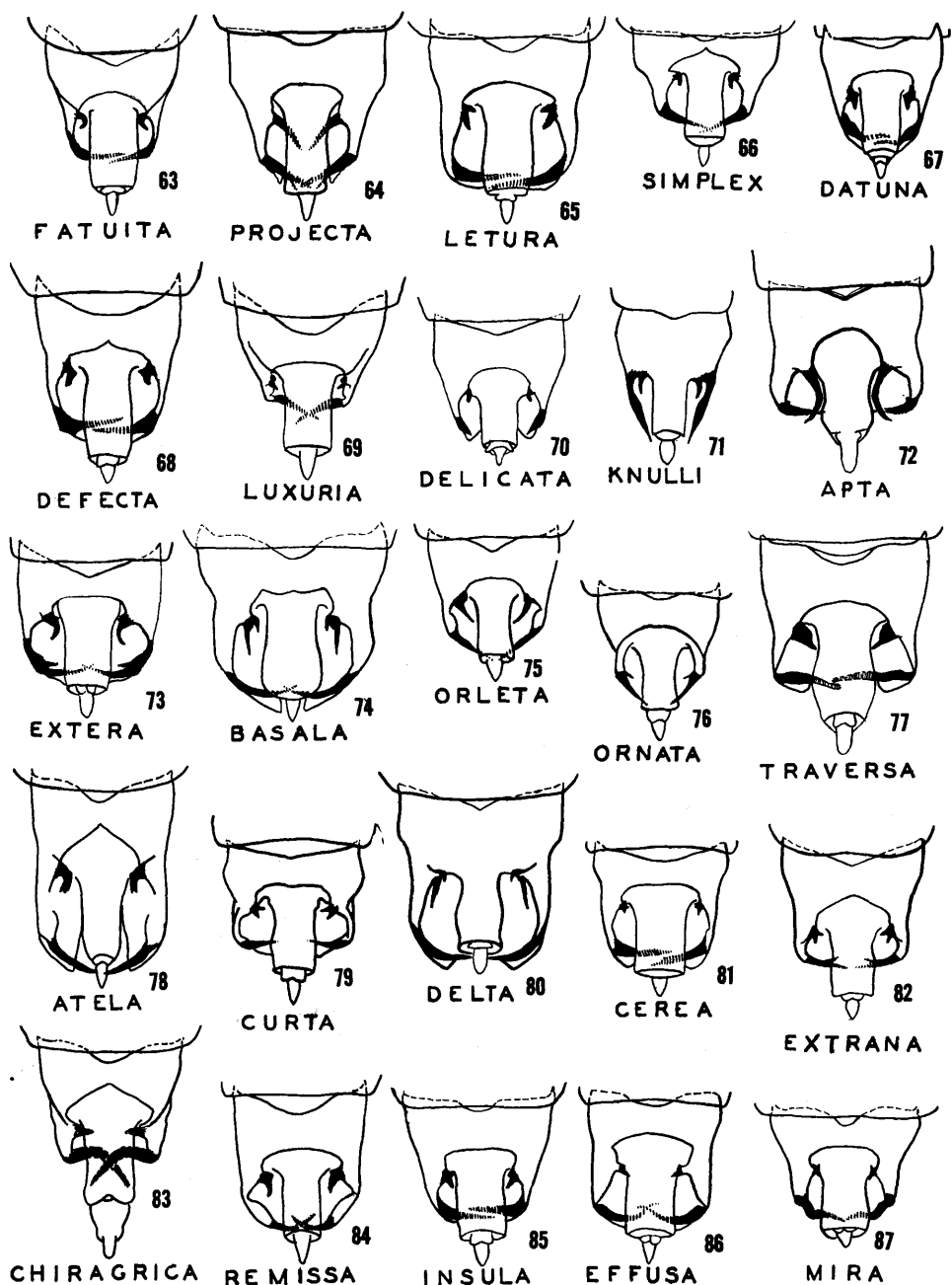
Thamnotettix vapida Ball, 1910: 305.

A brown species with a produced head and distinct male genital structures. Length: 5.5 to 6 mm.

Crown produced and pointed, more than two-thirds as long as basal width.

Color.—Crown and scutellum pale brown, pronotum darker brown tinged with buff. Forewings brown with pale mottling. The brown curved arcs from front visible on margin of crown from above. A diagonal dark dash on each side at apex.

Genitalia.—Female seventh sternum with produced, rounded lateral angles, between which the posterior margin is abruptly, broadly and deeply excavated on median half about one-third the distance to base. Male plates rather short, triangular, apices blunt. Pygofer a half longer than plates. Styles short, extending about one-third the length of plates. An-



FIGURES 63-87. Dorsal view of apical portion of male abdomen, illustrating position and type of spines, of species as labeled.

terlor spines thick, directed inwardly then bent sharply caudally. Posterior spine arms long, spines short, thick, slender apex curved inwardly, not reaching anal tube.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected in Tia Juana, Mexico, and Ti Juana, California. Specimens at hand are from La Jolla, California.

Ballana diversa Knull

(Figs. 42, and 175)

Ballana diversa Knull, 1951: 174.

A robust species, sexually dimorphic in color and with distinct male genital structures. Length: 6.5 to 7 mm.

Crown broad, produced and bluntly angled, about two-thirds as long at middle as basal width between eyes.

Color.—Male green, female brown; male crown and scutellum buff, pronotum green bordered with yellow; forewings dull green. Female crown pale with an irregular cross band of brown; arcs of front visible from above. Pronotum brown anterior border paler; scutellum pale brown, forewings dark brown.

Genitalia.—Female seventh sternum with rounded lateral angles between which the central two-thirds of posterior margin is broadly, rather shallowly excavated about one-fifth the distance to base. Male plates short and broad, not as long as pygofer, apices blunt. Styles short, extending about one-fourth the length of plates. Anterior spines short and thick, extending inwardly and curved caudally. Posterior spines long, extending inwardly and curved cephalad with apices crossing on median line near tips of anterior spines. A prominent spur on inner margin at about half the length of spine.

Type.—Knull collection.

Remarks.—Described from specimens collected near Carrizo, Arizona, from manzanita (*Arctostaphylos* sp). Specimens have been studied from Granite Dell, Chiricahua Mts., Santa Catalina Mts., Oak Creek Canyon, and Prescott National Forest, Arizona; and from San Diego, and Topanga Canyon, California.

Ballana latula DeLong

(Figs. 22, 37, and 156)

Ballana latula DeLong, 1937: 122.

Female resembling *vapida*, male greenish and with distinct genitalia. Length: 6.5 mm.

Crown broadly, very bluntly angled, twice as wide between eyes at base as median length, sharply angled with front.

Color.—Female pale brown on crown and scutellum. Pronotum and forewings dark brown flecked with yellow, apical veins yellow. Male crown yellowish, pronotum, scutellum and forewings bright green, apices of forewings smoky.

Genitalia.—Female seventh sternum broken but appearing truncate or slightly emarginate. Male plates long, one-fourth longer than combined width at base, convexly rounded, apical fourth more rapidly tapered to form bluntly pointed tips which are produced to length of anal tubes. Styles long, extending to half the length of the long plates. Anterior spines very heavy, long, extending to posterior spines. Posterior spines heavy at base, reaching to median line, bifid on apical half, apical arms divergent, transverse.

Type.—Ball collection, U. S. National Museum.

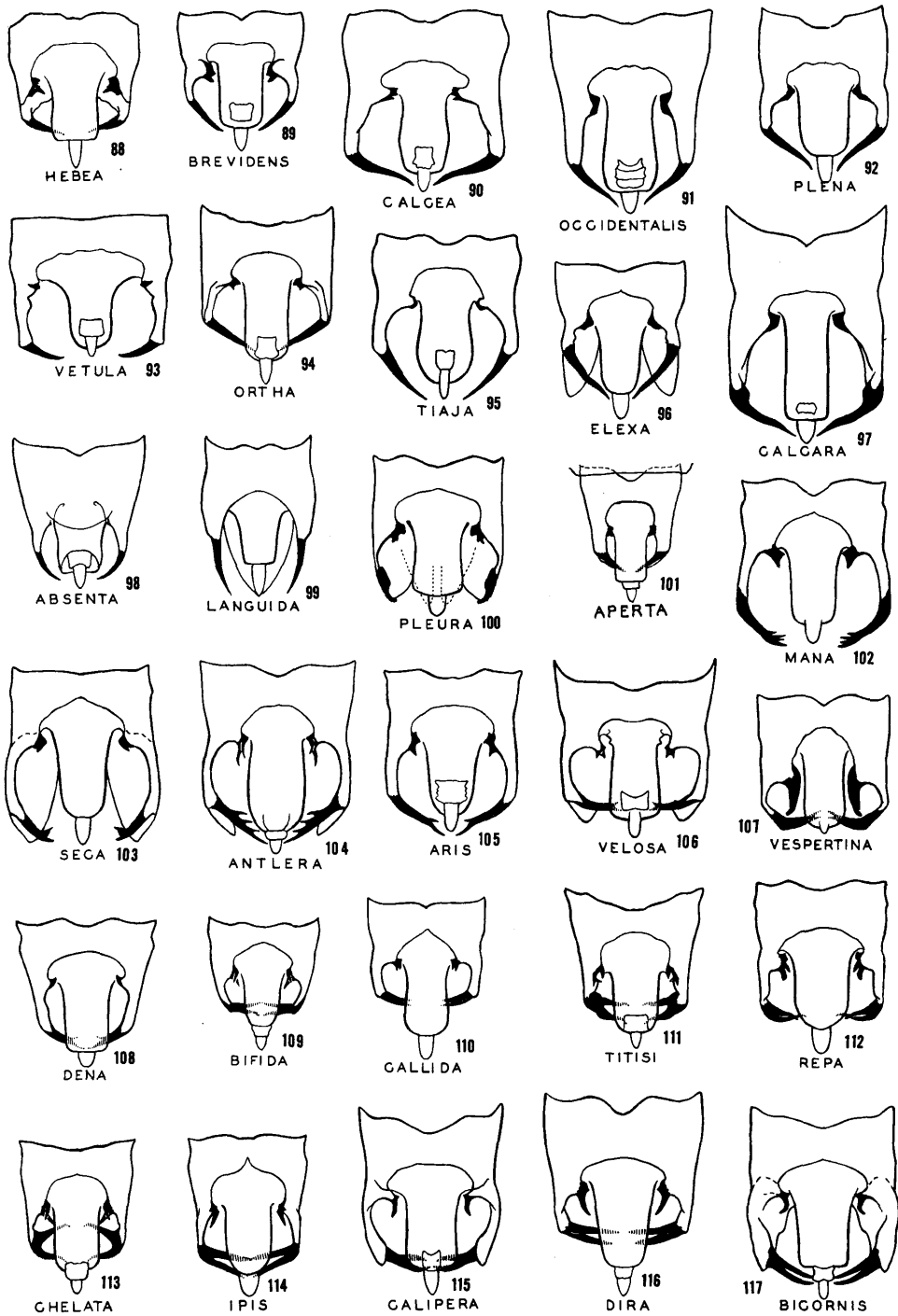
Remarks.—Described from specimens collected at Weed, California. Specimens from Shasta, California, have been examined.

Ballana densa sp. n.

(Figs. 41, 181, and 373)

Resembling *paridens* in form and appearance but with distinct male genital structures. Length: 6.5 to 7 mm.

Crown broad, bluntly angled, more than half as long at middle as basal width between eyes.



FIGURES 88-117. Dorsal view of apical portion of male abdomen, illustrating position and type of spines, of species as labeled.

Color.—In males crown yellow to pale brown, remainder of dorsal surface green tinged with yellow, forewings with apical cells smoky. The brown arcs from face visible on margin of crown from above. The females are usually buff to pale brown in color. Crown often marked with darker brown spots near apex. Pronotum, scutellum, and forewings usually brown with white mottling.

Genitalia.—Female seventh sternum with prominent, produced, narrow, rounded lateral angles between which the posterior margin is abruptly, broadly excavated almost one-third the distance to base. Male plates broad, as long as pygofer, apices narrowed and blunt. Styles more than half as long as plates and narrow. Anterior spines long, stout, and single, reaching to posterior spines which are quite short and bifid, not reaching to center of pygofer.

Holotype male.—Mt. St. Helena, Cal., June 19, 1941, D. J. and J. N. Knull. *Allotype female*.—Mt. Tamalpais, Cal., August 15, 1938, R. H. Beamer. *Paratypes*.—13 males, 8 females, same data as allotype; 6 males, 5 females, Davenport, Cal., August 13, 1938, R. H. Beamer; 22 males and 44 females, Santa Cruz Mt., Cal., August 13, 1938, R. H. Beamer; 55 males and 50 females, Monterey, Cal., August 10, 1938, Beamer, Sailer, Hepner, Craik; 5 males, 6 females, Occidental, Cal., August 16, 1938, Beamer, Sailer; 1 male, 6 females, Ben Lomond, Cal., August 4, 1938, Beamer; and 6 males, Lucerne, Cal., July 17, 1935, Beamer. Holotype and paratypes in the DeLong collection. Allotype and paratypes in the University of Kansas collection. Paratype in the U. S. National Museum collection, and in The Ohio State University collection.

Remarks.—This species has been collected in abundance from *Arctostaphylos montana* East, *pumila* Nutt., *tomintosa* Pur., *canescens* East, and *glandulosa* East.

***Ballana aleta* sp. n.**

(Figs. 19, 34, and 177)

Resembling *paridens* in form and appearance but with distinct male genital structures. Length: 7 mm.

Crown produced and pointed, more than half as long at middle as basal width between eyes.

Color.—Male crown buff with the arcs from face showing on margin from above and a pair of diagonal dashes just back of apex; scutellum yellow. Pronotum and forewings dull pale green. Face buff with dark arcs. Female with crown and scutellum buff, pronotum and forewings brown. The forewing with white stippled markings.

Genitalia.—Female seventh sternum with prominent produced lateral angles. The central half of posterior margin is abruptly, broadly excavated one-fourth the distance to base; the posterior margin of the excavation is convexly rounded. Male plates broad and almost as long as pygofer, outer margins convexly rounded, apices together, rounded. Styles long, extending more than half the length of plates. Anterior spines short, thick at base, apical half slender, apex pointed. Posterior spines with a conspicuous heavy spur near base, spines simple, bent forward and inwardly, extending beyond median line of pygofer.

Holotype male and allotype female.—Yosemite National Park, Cal., August 1, 1940, D. J. and J. N. Knull. Holotype and allotype in DeLong collection.

***Ballana directa* sp. n.**

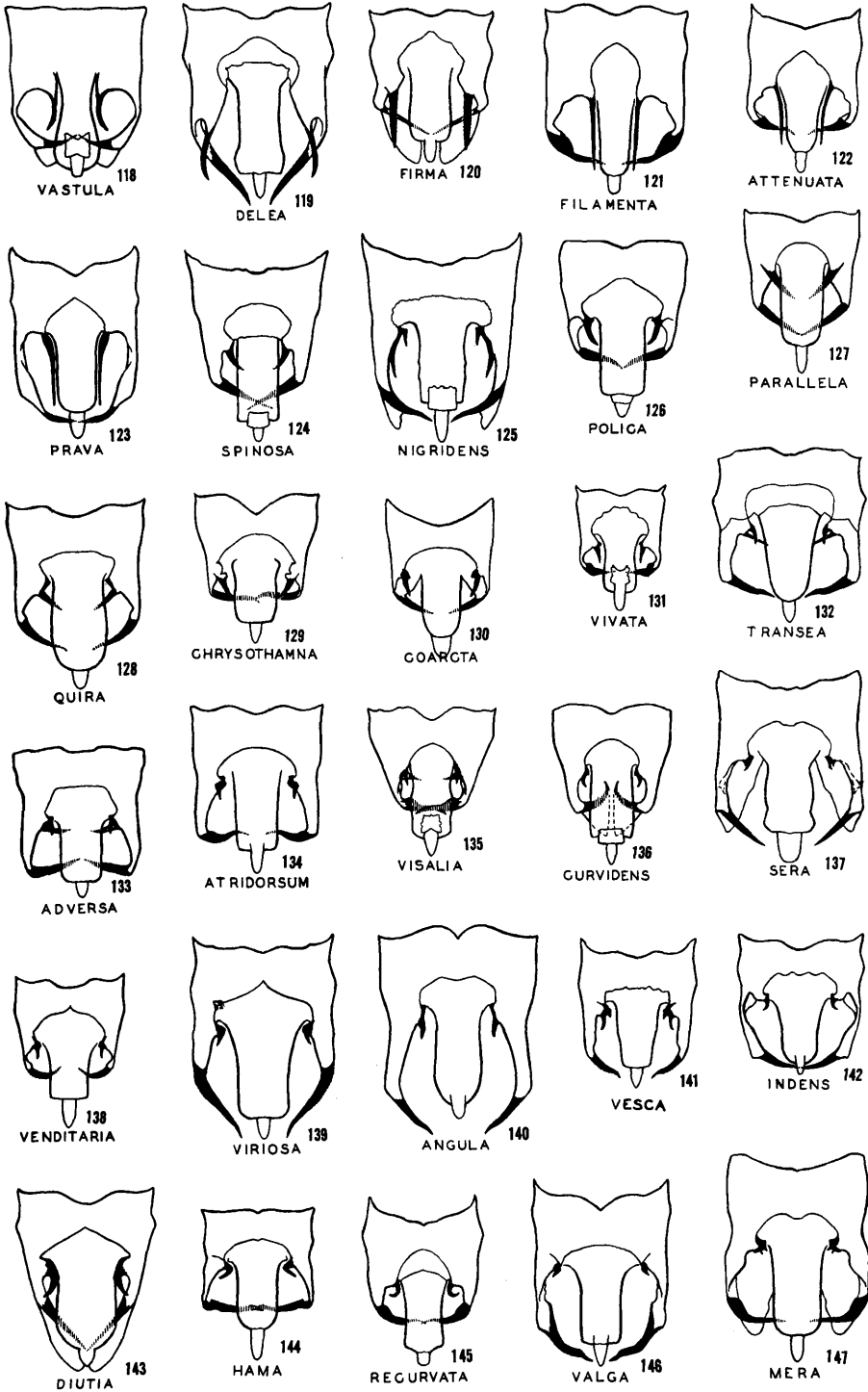
(Figs. 47, 209, and 399)

Resembling *diversa* in form and general appearance but with distinct male genital structures. Length: 6 to 6.5 mm.

Crown bluntly angled anteriorly, not quite two-thirds as long at middle as basal width between eyes.

Color.—Variable; males usually pale green to pale brown, forewings with apical area brown, female usually brownish. In all specimens the crown, pronotum, and scutellum are usually yellow to pale brown. Arcs on face usually conspicuous and curved up on to anterior portion of crown.

Genitalia.—Female seventh sternum with posterior margin broadly, shallowly excavated between slightly produced and rounded lateral angles. Male plates rather small, triangular,



FIGURES 118-147. Dorsal view of apical portion of male abdomen, illustrating position and type of spines, of species as labeled.

with apices bluntly angled, well exceeded in length by the pygofer. Styles medium in length, extending to half the length of plates. Anterior spines very short and with a basal spur, appearing bifid. Posterior spines single, short, transverse, not reaching median line of pygofers.

Holotype male.—Towie, Calif., August 20, 1938, R. I. Sailer. *Allotype female*.—Towie, Calif., August 20, 1938, R. H. Beamer. *Paratypes*.—5 males, same locality and date as holotype; and 7 females, same locality and date as allotype. Holotype, allotype, and paratypes in University of Kansas collection. Paratypes in DeLong collection.

***Ballana radiata* sp. n.**

(Figs. 40 and 202)

Resembling *filamenta* in form and general appearance but with distinct male genital structures. Length: 6 mm.

Crown flat, margin broadly angled, about two-thirds as long as width between eyes at base.

Color.—Green, crown yellow, pronotum and scutellum tinged with yellow, face and beneath brown. Face with dark arcs. Forewings with apical cells hyaline, without color.

Genitalia.—Male plates broad, medium in length, apices rather broad and blunt, not extending to length of pygofer. Styles medium in length, extending to about half the length of plates. Anterior spines short, spur-like, extending inwardly. Posterior spines bifid near base, thick, the anterior arm shorter than posterior arm.

Holotype male.—Placer Co., Calif., September, C. F. Baker, in A. Koebele collection. Holotype in U. S. National Museum collection.

***Ballana extrema* sp. n.**

(Figs. 15, 33, and 176)

Resembling *latera* in form and appearance but with distinct male genital structures. Length: 7 mm.

Crown produced and bluntly angled, almost two-thirds as long at middle as basal width between eyes.

Color.—Dimorphic in the same sex. May be bright green with yellowish crown and tip of forewings smoky, or may be brown. In the latter specimens the crown is tawny with the dark arcs of face extending onto margin of crown. The pronotum and scutellum are brown. Forewings brown mottled with bright yellow. Face pale brown in both color forms.

Genitalia.—Female seventh sternum with posterior margin broadly, shallowly, concavely excavated between the lateral angles. Male plates long and tapered to pointed apices, well exceeding pygofer. Styles long, but not extending to middle of plates in view of their extreme length. Anterior spines transverse and thick at base, the apical half extends abruptly caudally almost to posterior spines and tapers to pointed apices. Posterior spines single, transverse, tapered to slender pointed apices which do not extend to median line of pygofer.

Holotype male.—Redding, Cal., June 28, 1935, Oman. *Allotype female*.—Redding, Cal., June 28, 1935, R. H. Beamer. *Paratypes*.—1 male, same data as holotype; 3 males, 3 females, same data as allotype; June 28, 1935, R. H. Beamer; 4 males, 5 females, Dales, Cal., June 28, 1935, R. H. Beamer; 1 male, Dunsmuir, Cal., June 29, 1935, R. H. Beamer; 7 males, Paynes Cr., Cal., June 27, 1935, Oman; and 4 males, Delta, Cal., June 28, 1935, Oman. Holotype and paratypes in the U. S. National Museum collection. Allotype and paratypes in the University of Kansas collection. Paratypes in the DeLong collection and The Ohio State University collection.

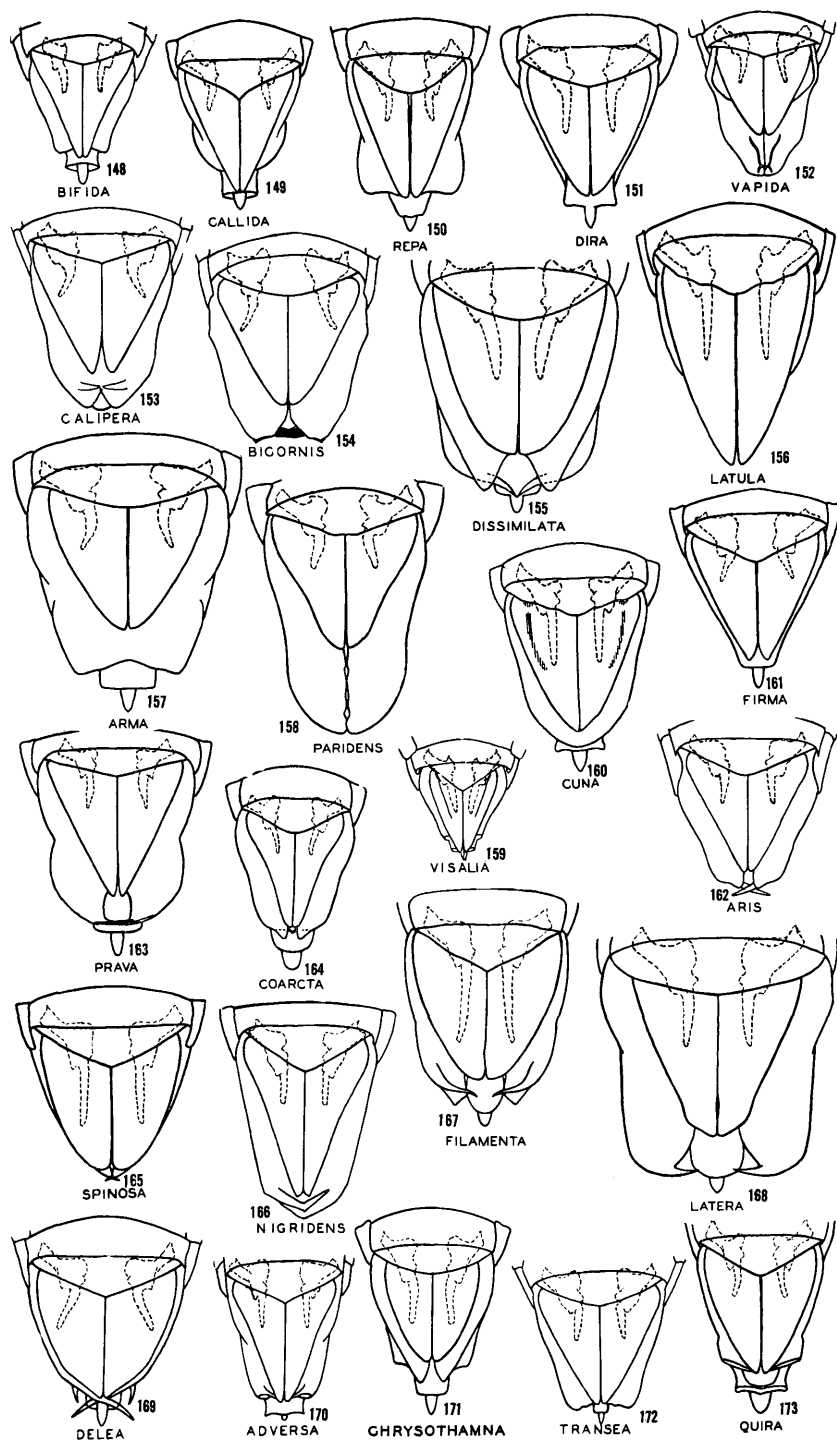
***Ballana tolara* sp. n.**

(Figs. 52, 198, and 378)

Resembling *diversa* in form and general appearance but with distinct male genital structures. Length: 5.5 to 6 mm.

Crown bluntly angled, two-thirds as long at middle as basal width between eyes.

Color.—Brownish, forewings usually faintly mottled with white. Face with brown arcs



FIGURES 148-173. Ventral view of apical portion of male abdomen, illustrating plates and style, of species as labeled.

which curve onto anterior margin of crown. Crown pale brownish with a darker spot each side of apex and usually a spot behind each ocellus. Pronotum and scutellum usually irregularly marked with brownish.

Genitalia.—Female seventh sternum with posterior margin broadly, shallowly excavated between the slightly produced and rounded lateral angles. Male plates broad, triangular, apices narrow and well rounded, as long as pygofer. Styles medium, reaching almost to middle of plates. Anterior spines short, slender with a basal spur. Posterior spines long, stout, extending beyond middle and crossing, each with a caudo-ventral spur at about half its length.

Holotype male.—Big Bear Lake, Calif., July 26, 1932, R. H. Beamer. *Allotype female*.—Same locality and date. *Paratypes*.—5 males, 5 females, same locality and date. Holotype, allotype, and paratypes in the University of Kansas collection. Paratypes in DeLong collection.

***Ballana youngi* sp. n.**

(Figs. 61, 217, and 402)

Resembling *chelata* in form and general appearance but with distinct male genitalia. Length: 6 mm.

Crown produced and angled, almost twice as wide between eyes at base as median length.

Color.—Apparently sexually dimorphic. The males are green unmarked with a yellowish crown. Face marked with brownish arcs. The female appears brown. The crown is pale brown with arcs from the face at margin and a pair of marks at apex, darker brown. The scutellum and forewings are darker brown.

Genitalia.—Female seventh sternum broadly and rather deeply excavated on median half between the produced, rounded, lateral angles; the excavation is about one-fourth the distance to base. Male plates rather long but exceeded in length by pygofer, apices divergent and blunt. Styles medium in length, extending to half the length of plates. Anterior spines short with a basal spur. Posterior spines single, extending inwardly and caudally, one on each side of anal tube; heavy at base with slender and pointed apex.

Holotype male, female allotype, 22 male paratypes, and 22 female paratypes.—Kerby, Oregon, July 15, 1935, R. H. Beamer. Holotype, allotype, and paratypes in the University of Kansas collection. Paratypes in the U. S. National Museum collection, the DeLong collection, and The Ohio State University collection.

SUBGENUS *Viriosana*

Vertex blunt and rounded, margin thick and rounded to front, broadly rounded between eyes.

***Ballana omani* sp. n.**

(Figs. 17, 35, and 174)

Resembling *quira* in form and appearance but with distinct male genital structures. Length: 6 to 6.5 mm.

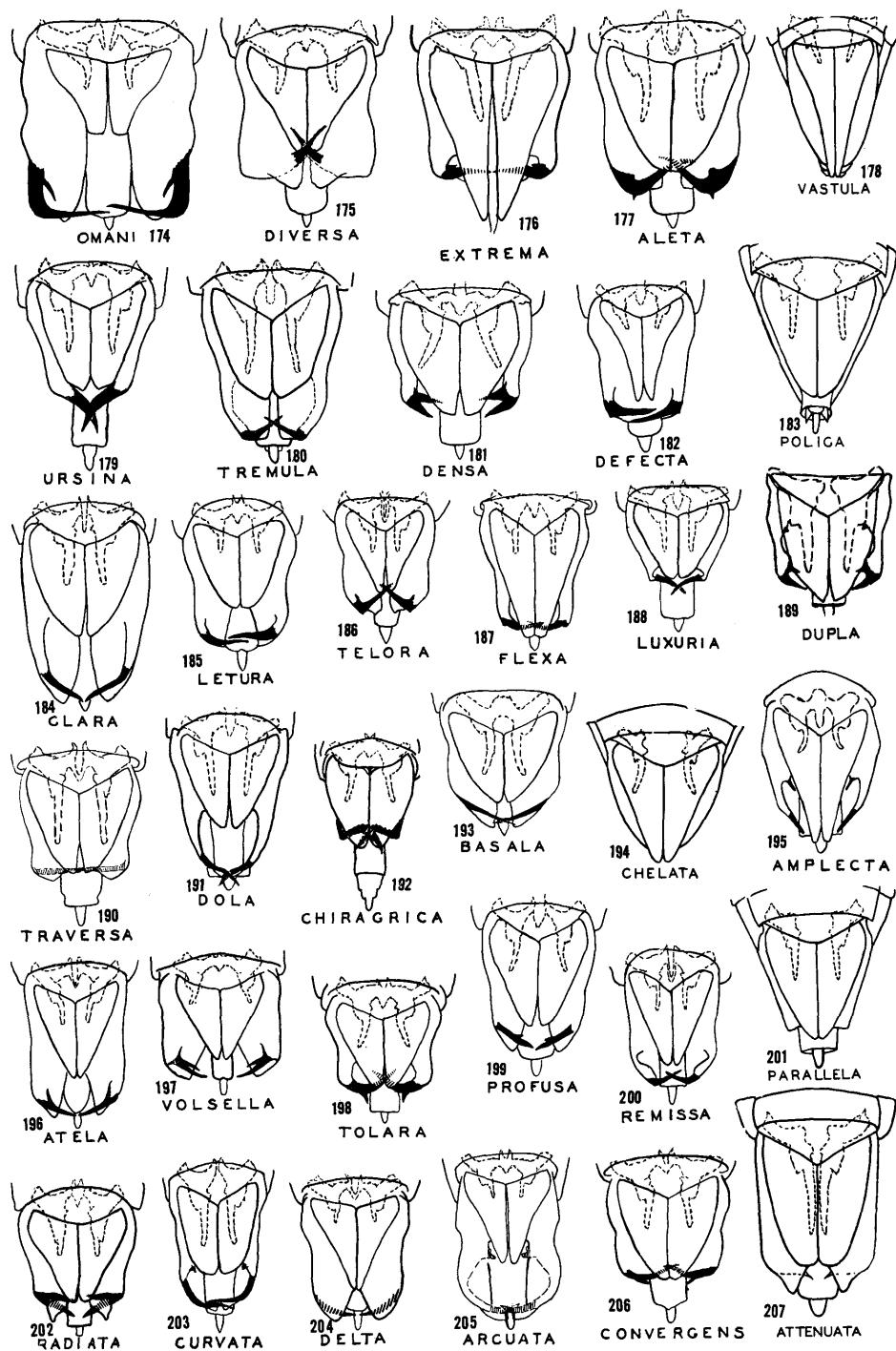
Crown bluntly angled, more than half as long at middle as basal width between eyes.

Color.—Male with crown, pronotum, and scutellum pale yellowish washed with green. Forewing green with hyaline-smoky apices. Female crown buff; pronotum, scutellum, and forewings buff tinged with pale brown.

Genitalia.—Female seventh sternum with produced, rounded lateral angles, between which the posterior margin is broadly, concavely excavated about one-fifth the distance to base. Male plates quite small, triangular, apices blunt, appearing truncate; greatly exceeded in width and length by the large pygofer. Styles small, but extending almost to middle of plates. Anterior spines rather short and slender. Posterior spines curved at right angles, the apical two-thirds transverse extending beyond middle of pygofer. A spur arises on inner margin near base and extends caudally.

Holotype male, allotype female, and male paratype.—Pinal Mts., Ariz., May 22, 1937, E. D. Ball. Holotype and allotype, in the U. S. National Museum collection. Paratype in the DeLong collection.

Remarks.—A brownish specimen without abdomen is apparently a female of this species.



FIGURES 174-207. Ventral view of apical portion of male abdomen, illustrating plates and style, of species as labeled.

***Ballana tremula* sp. n.**

(Figs. 21, 39, and 180)

Resembling *seca* in form and appearance but with distinct male genital structures. Length: 6.5 to 7 mm.

Crown produced and bluntly angled, two-thirds as long at middle as basal width between eyes.

Color.—Crown yellow, pronotum and scutellum yellow tinged with green; forewings pale green, apical cells hyaline.

Genitalia.—Female seventh sternum with median portion of posterior margin deeply cleft by a broad V-shaped notch which is rounded and black margined at apex and extends more than two-thirds the distance to base. Lateral angles broadly rounding to the notch. Male plates broad and short, with blunt apices greatly exceeded in length by pygofer. Styles long, extending almost to the length of plates. Anterior spines short, consisting of two heavy spurs. Posterior spines long, heavy, apical half bent inwardly and cephalad and extending beyond the median line. A spur arises on inner margin near base.

Holotype male, allotype female and male paratype.—Lucerne, Calif., July 17, 1935, Jack Beamer. *Female paratype*.—Alameda Co., Calif., July 19, 1933, Jean Russell. Holotype, allotype, and paratype in the University of Kansas collection. Male paratype in DeLong collection.

***Ballana curvidens* DeLong**

(Figs. 136, 233, 312, and 367)

Ballana curvidens DeLong, 1937: 111.

Resembling *spinosa* in form and appearance but with distinct genitalia. Length: 5.5 mm.

Crown roundedly produced but scarcely angled, margin thick, rounding to front, almost twice as wide between eyes at base as length at middle.

Color.—Crown yellowish; pronotum, scutellum, and forewings dull greenish.

Genitalia.—Female seventh sternum with posterior margin forming a slightly indented median lobe on central half. Male plates rather long, about one-fourth longer than combined basal width, slightly convexly rounded to bluntly pointed apices which do not reach the end of the anal tube. Styles medium in length, extending to about one-third the length of the plates. Anterior spines short, extending caudally, apices curved inwardly. Posterior spines heavy, curved inwardly, apices extending cephalad and to median line.

Type.—DeLong collection.

Remarks.—Described from specimens from Minidoka, American Falls, Twin Falls, and Craters of the Moon, Idaho. Specimens from Richfield, Idaho, have been examined.

***Ballana venditaria* (Ball)**

(Figs. 9, 138, 241, 315, and 390)

Thamnotettix venditaria Ball, 1910: 266.

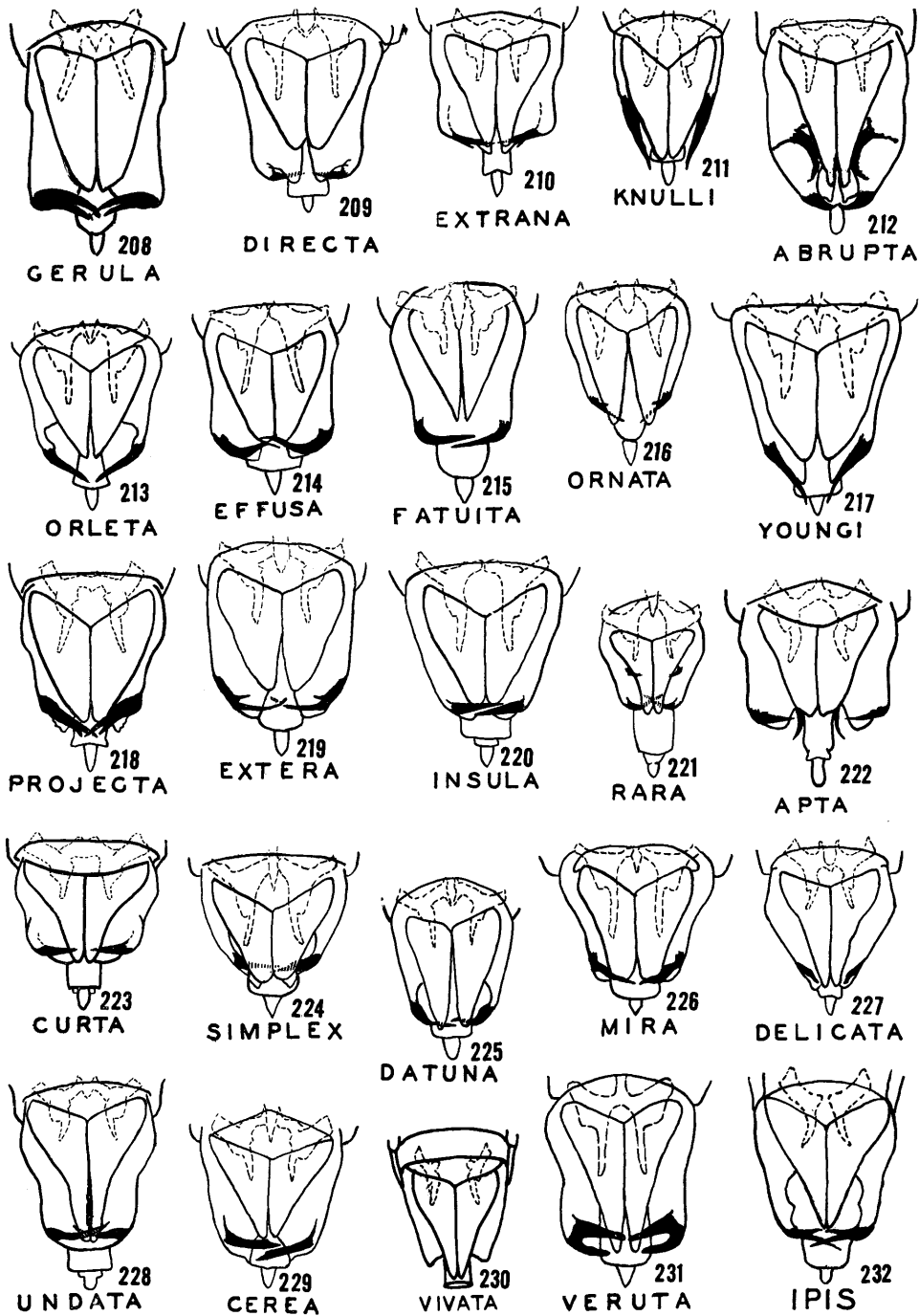
A green, well marked species with distinct male genital structures. Length: 5.5 mm.

Crown produced and rounded on anterior margin, about two-thirds as long at middle as basal width between eyes.

Color.—Crown and scutellum yellow, pronotum green tinged with yellow, forewings pale green. Arcs of face showing from above. Crown with a pair of large, brown spots just above margin not far from eyes and a pair of very small proximal spots at apex. Scutellum with a large spot in each basal angle. Face pale with dark arcs.

Genitalia.—Female seventh sternum with rounded lateral angles between which the posterior margin is broadly, shallowly excavated. Male plates triangular, apices bluntly pointed, extending to posterior spines. Styles short, extending about one-fourth the length of the plates. Anterior spines composed of a short, stout, spur directed caudally. The posterior spines short, thick, curved inwardly, not reaching median line with the apices curving cephalad.

Type.—Ball collection, U. S. National Museum.



FIGURES 208-232. Ventral view of apical portion of male abdomen, illustrating plates and style, of species as labeled.

Remarks.—Described from specimens from Reno, Nevada; and from Utah. Specimens from Twin Falls, Idaho Falls, Aberdeen, and Minidoka, Idaho, have been examined.

Ballana vivata (Ball)

(Figs. 5, 131, 230, 308, and 338)

Thamnotettix titusi var. *vivata* Ball, 1910: 302.

A green blunt headed species with distinct male genital structures. Length: 4.5 mm.

Crown produced and bluntly angled, more than two-thirds as long at middle as basal width between the eyes.

Color.—Crown and scutellum yellow, pronotum green tinged with yellow, forewings green with yellow veins.

Genitalia.—Female seventh sternum with posterior margin broadly, shallowly, emarginate. Male plates long, tapered to pointed apices, extending beyond posterior spines. Styles short, extending onto base of plates only. Anterior spines short, thick, directed caudally. Posterior spines short, transverse, tapered rapidly from a thick base to slender apices which do not extend to median line.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at Ti Juana, Riverside, and Pasadena, California; and Reno, Nevada. Specimens from Waldport, Oregon; Victorville, California; and Sabina Canyon, Arizona; have been examined.

Ballana atridorsum (Van Duzee)

(Figs. 134, 247, 322, and 346)

Thamnotettix atridorsum V.D., 1894: 92.

A pale green species with a bluntly produced head. Length: 4.5 to 5.5 mm.

Crown produced and blunt at apex, about two-thirds as long at middle as basal width between eyes.

Color.—Pale yellow tinged with green. Crown and scutellum mostly yellow.

Genitalia.—Female seventh sternum with posterior margin shallowly but rather broadly excavated on the median fourth. Male plates slightly longer than combined basal width, sides almost straight, apices rather broad, rounded, extending to the posterior spines. Male in dorsal view with ninth segment broader than long, narrowed from base to apex. Anterior spines very short, arising at posterior portion and directed caudally. Posterior spines long and heavy, extending beyond median line and slightly curving upward.

Remarks.—This species was originally described from three female specimens from Colorado. In 1937 the writer attempted to recognize a topotype male selected by Prof. Herbert Osborn. In 1947 Oman studied the Iowa State College types and selected a specimen in the U. S. National Museum collection which he designated the lectotype. The proper designation of a male is therefore confused at this time, but a male that seems to be logical for this species is illustrated.

Other specimens that apparently are *atridorsum* are from Rapid City, S. D.; and Lusk, Wyoming. The distribution is apparently in the eastern portion of the Rockies.

Ballana indens DeLong

(Figs. 7, 142, 238, 316, and 381)

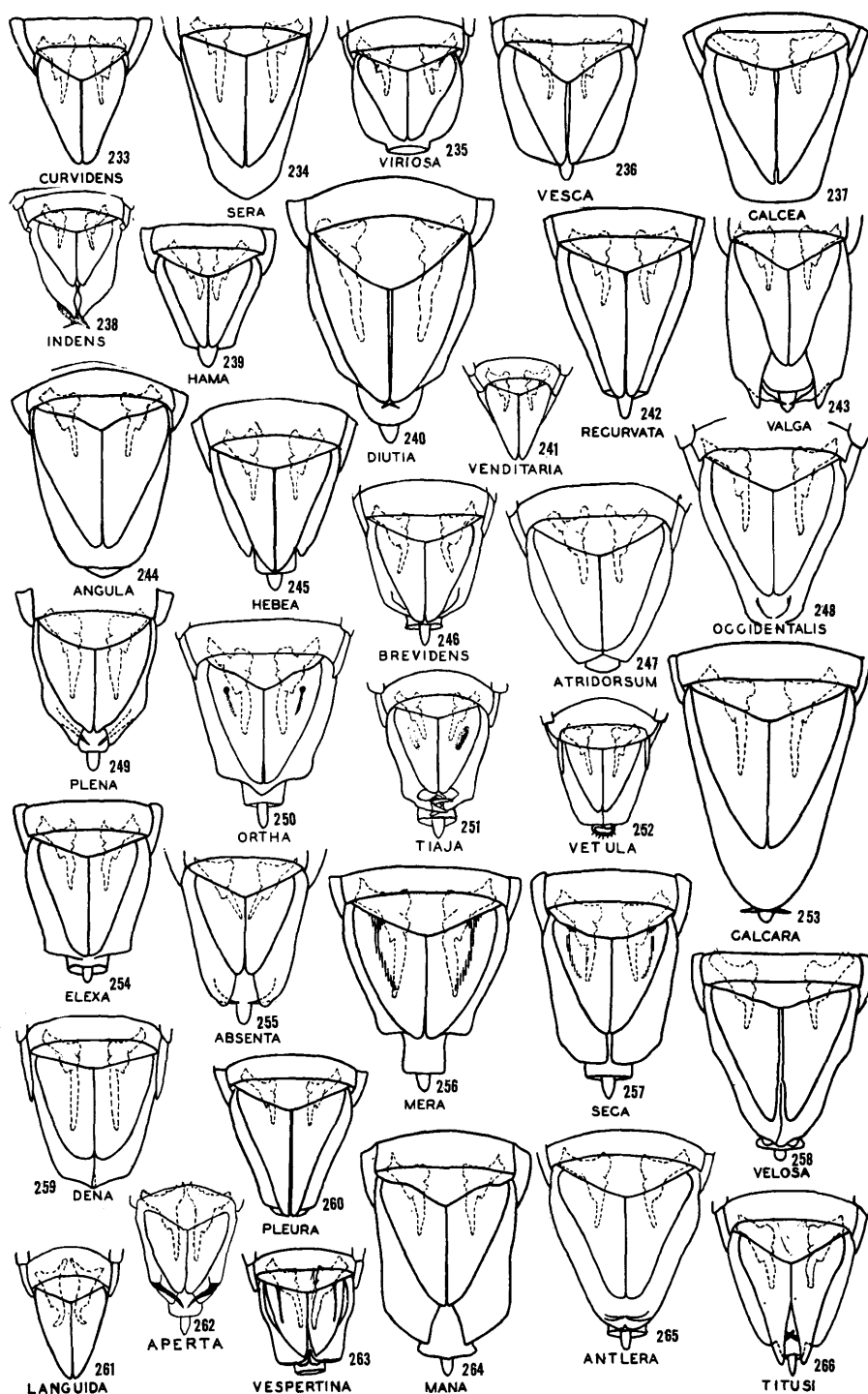
Ballana indens DeLong, 1937: 114.

In general appearance resembling *vetula* but with distinct genitalia. Length: 5 to 5.5 mm.

Crown bluntly angled, almost rounded, one-third wider between eyes at base than median length. Margin thick.

Color.—Pale yellow, pronotum and forewings slightly darker.

Genitalia.—Female seventh sternum narrowed to apex, lateral angles bluntly rounded between which the posterior margin is slightly emarginate and truncate. A heavy black mark causes it to appear rather deeply and doubly notched. Male plates about as long as combined



FIGURES 233-266. Ventral view of apical portion of male abdomen, illustrating plates and style, of species as labeled.

basal width, broadly triangular, apices blunt and rounded, not reaching posterior spines by about one-third their length. Styles short, extending to about one-third the length of plates. Anterior spines very short, a spur only, which is directed caudally. Posterior spines almost transverse, curved slightly caudally, narrowed to pointed apices which extend to median line.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at Doyle, California.

Ballana hama DeLong

(Figs. 144, 239, 318, and 351)

Ballana hama DeLong, 1937: 115.

Resembling *pleura* in general appearance but with more produced crown and distinct genitalia. Length: 4.5 mm.

Crown strongly produced and bluntly angled, one and one-half times as wide between eyes at base as length at middle.

Color.—Greenish washed with yellow, pale brownish arcs extending onto margin of crown from front. A pair of small brown spots on base of crown. Forewings with apices smoky, veins pale.

Genitalia.—Female seventh sternum with lateral margins obliquely sloping to posterior margin which is slightly excavated on median third and margin truncated. Male plates as long as combined width at base, sides almost straight, apices bluntly pointed, almost reaching posterior spines. Styles short, extending to about one-fourth the length of plates. Anterior spines short, curved back upon themselves, apex extending outwardly and caudally. Posterior spines transverse, long, extending beyond median line.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at Beaumont, California.

Ballana recurvata DeLong

(Figs. 145, 242, 324, and 339)

Ballana recurvata DeLong, 1937: 117.

Resembling *vastula* in form and appearance but with distinct genitalia. Length: 5 to 5.5 mm.

Crown sharply angled, apex blunt, bluntly angled with front, about one-fourth wider between eyes at base than length at middle.

Color.—Crown and scutellum yellowish, pronotum dull green, forewings dull greenish, apical portion posterior to cross veins, brownish.

Genitalia.—Female seventh sternum roundedly produced, central third forming a slightly sunken, almost truncated lobe. Male plates rather long, about one-fourth longer than combined width at base, gradually sloping to bluntly pointed apices which extend just to apex of anal tube. Styles short, extending about one-fifth the length of plates. Anterior spines short, curved, apices directed outwardly. Posterior spines rather long, apical half transverse, reaching to median line.

Type.—DeLong collection.

Remarks.—Described from specimens collected at Boise, Idaho; Santa Margarita, California; Medford, Oregon. Other specimens examined are from Satus Pass and Toppenish, Washington; Medford and Yoncalla, Oregon; Humbolt, Nevada; Boise, Idaho; Oroville and Mt. St. Helena, California.

It has been collected from carrots, turnips, beans, and mustard.

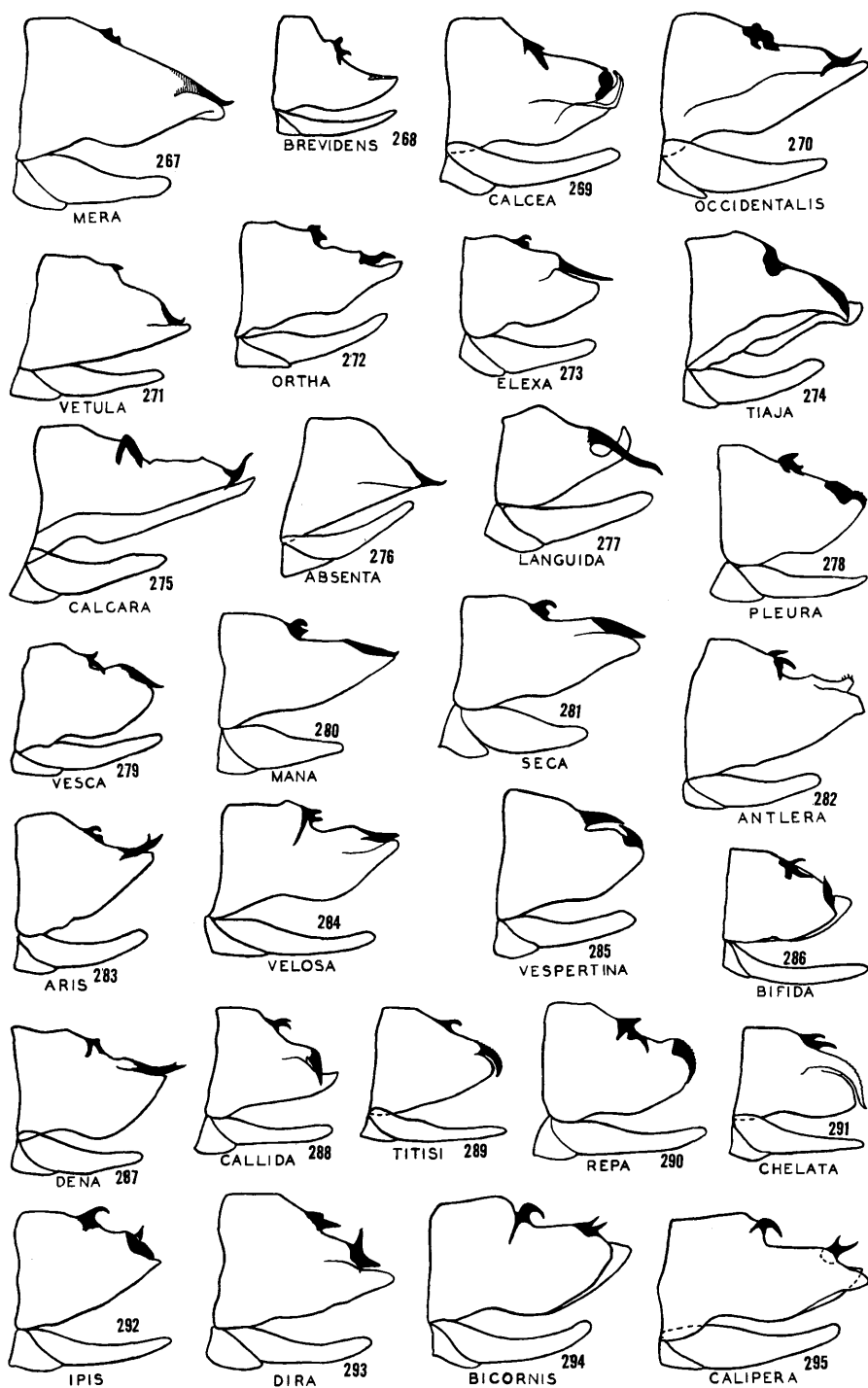
Ballana diutia DeLong

(Figs. 143, 240, and 319)

Ballana diutia DeLong, 1937: 115.

In form and appearance resembling *vesca* but with distinct genitalia. Length: 4.5 mm.

Crown bluntly angled, almost twice as wide between eyes at base as length at middle. Margin thick, almost rounded to front.



FIGURES 267-295. Lateral view of apical portion of male abdomen of species as labeled.

Color.—Crown and scutellum yellow, pronotum and forewings gray tinged with yellow.

Genitalia.—Male plates about as long as combined basal width, sides convexly rounded, apices broad, rounded, reaching almost to posterior spines. Styles long, extending more than half the length of plates. Anterior spines thick, rather short, extending caudally, apices curved outwardly. Posterior spines rather long, tapered to pointed apices, directed obliquely to base of anal tube, reaching median line.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from a male specimen collected at Mojave, California.

Ballana vesca (Ball)

(Figs. 11, 141, 236, 279, and 366)

Thamnotettix atridosrum var. *vesca* Ball, 1910: 302.

Ballana gruis DeLong, 1937: 114.

A short, stout, green species with distinct male genital structures. Length: 4 to 5 mm.

Crown bluntly angled, almost rounded in front, margin thick, one-third wider between eyes at base than length at middle.

Color.—Crown, pronotum, and scutellum yellowish; disc of pronotum green. Forewings green, veins yellowish.

Genitalia.—Female seventh sternum convexly roundedly narrowed to posterior margin which occupies the middle half of segment and is truncated or slightly convexly rounded. Lateral plates prominent. Male plates about as long as combined basal width, sides almost straight, apices bluntly pointed, not quite reaching to posterior spines. Styles short, extending onto base of plates only. Anterior spines short, a slender spur is directed caudally. Posterior spines short, directed inwardly and caudally and not approximating the anal tube.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at Coronado Beach, Long Beach, and Redondo Beach, California. Other specimens are at hand from Oxnard, California.

Ballana sera DeLong

(Figs. 137, 234, 323, and 330)

Ballana sera DeLong, 1937: 113.

Resembling *atridorsum* in form and general appearance but larger, with crown more bluntly angled and with distinct male genitalia. Length: 6 to 6.5 mm.

Anterior margin thick, crown bluntly angled, one and one-half times as wide between eyes at base as length at middle.

Color.—Crown, anterior margin of pronotum and scutellum yellowish. Disc of pronotum and forewings yellowish, appearing green where covering abdomen.

Genitalia.—Female seventh sternum with lateral margins convexly rounding from near base to posterior margin, the central third of which is abruptly excavated about one-fourth the distance to base, the base of which is slightly convexly rounded. Male plates about as long as combined basal width, sides convexly rounded, apices bluntly pointed, not reaching to posterior spines by about one-fourth their length. Styles medium in length, extending to about half the length of plates. Anterior spines represented by a small plate with a minute caudal spur. Posterior spines medium in length; straight, rather heavy, directed obliquely caudally, but not approximating the anal tube.

Type.—Ball collection, U. S. National Museum.

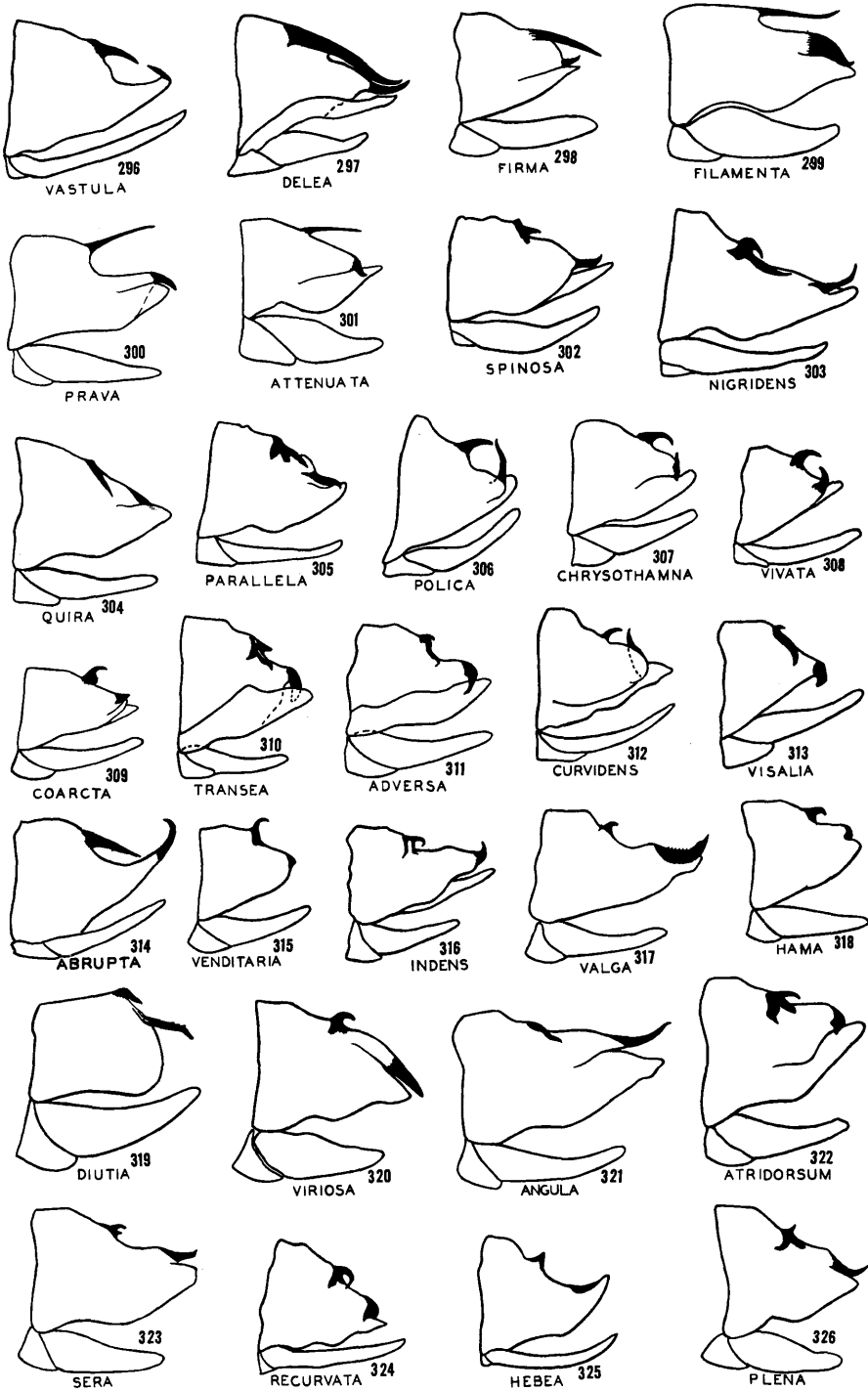
Remarks.—Described from specimens collected at Beaumont, California. Specimens from Mint Canyon, California, have been examined.

Ballana angula DeLong

(Figs. 140, 244, 321, and 335)

Ballana angula DeLong, 1937: 116.

In general form resembling *valga* but with greenish color and distinct genitalia. Length: 5 mm.



FIGURES 296-326. Lateral view of apical portion of male abdomen of species as labeled.

Crown only slightly produced and bluntly angled, twice as wide between eyes at base as median length.

Color.—Male pale green tinged with yellow, female pale yellow unmarked.

Genitalia.—Female seventh sternum with lateral margins strongly convexly rounded from base to posterior margin which is slightly and broadly excavated, the posterior margin of which is convexly rounded. Male plates about as long as combined basal width, side margins straight, apices rather broad, rounded, not reaching posterior spines by about one-third their length. Styles long, extending about two-thirds the length of the plates. Anterior spines short, thick, directed caudally. Posterior spines rather long, directed caudally and sloping inwardly, but caudal to the anal tube and not approximating it.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at Gila Bend, Arizona.

Ballana viriosa (Ball)

(Figs. 4, 139, 235, 320, and 406)

Thamnotettix viriosa Ball, 1910: 266.

A blunt headed species with color markings and with distinct male genital structures. Length: 5.5 to 6 mm.

Crown produced, but rounded, more than half as long at middle as basal width between eyes.

Color.—Crown cream with a large square spot next each eye on margin, and a pair of diagonal spots at apex which may merge with each other and the arcs from face which are visible from above. A pair of faint spots at base. Pronotum gray green, bordered with yellow. Scutellum yellow. Forewings gray-green covered with a whitish film.

Genitalia.—Female seventh sternum with posterior margin slightly broadly emarginate. Male plates broad, apices broad and blunt, not extending to posterior spines. Styles rather short, extending about a third the length of plates. Anterior spines very short, thick, extending caudally. Posterior spines long, thick at base, tapered to slender apices which are caudally directed, bent inwardly, and extend to length of anal tube but some distance away from it.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens from Beaumont, California.

Ballana simplex sp. n.

(Figs. 20, 66, and 224)

Resembling *valga* in form and appearance but with distinct male genital structures. Length: 5.5 mm.

Crown produced but blunt, almost rounded; about two-thirds as long at middle as basal width between eyes.

Color.—Greenish gray, appearing white; crown buff, face buff with faint arcs.

Genitalia.—Female seventh sternum with rounded lateral angles between which the median third of posterior margin is abruptly excavated, forming a broad U, about one-fifth the distance to base. Male plates rather broad, as long as pygofer, apices blunt, rounded. Styles more than half as long as plates, slender. Anterior spines very short, single. Posterior spines single, almost transverse, reaching beyond middle of pygofer.

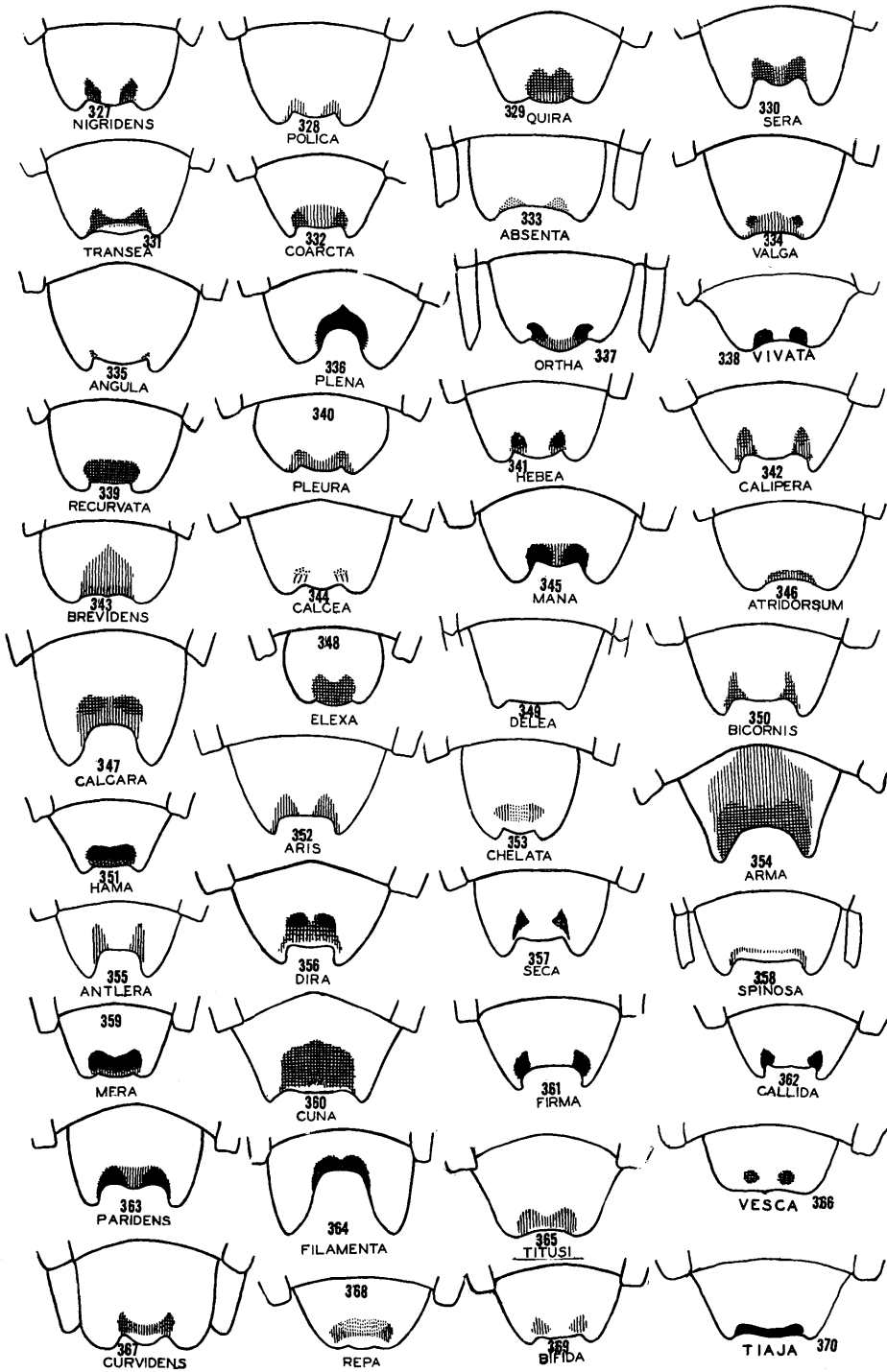
Holotype male, allotype female, 2 male and 1 female paratype.—Jacumba, Cal., June 3, 1941, D. J. and J. N. Knull. Holotype, allotype, and paratypes in the DeLong collection. Paratype male in the U. S. National Museum collection.

Ballana rara sp. n.

(Figs. 44, 221, and 392)

Resembling *apta* in form and general appearance but with distinct male genital structures. Length: 4.5 to 5 mm.

Crown well produced and bluntly angled, almost as long at middle as basal width between the eyes.



FIGURES 327-370. Female seventh sternum of species as labeled.

Color.—Crown and scutellum buff, pronotum and forewings light green.

Genitalia.—Female seventh sternum with posterior margin broadly, convexly rounded. Male plates concavely tapered to narrow pointed apices, extending to posterior spines. Styles short, extending onto base of plates. Anterior spines absent. Posterior spines short, single, transverse, extending beyond middle of pygofer.

Holotype male, allotype female, and female paratype.—Kanab, Utah, June 26, 1935, E. D. Ball. Holotype and allotype, in the U. S. National Museum collection. Paratypes in the DeLong collection.

***Ballana defecta* sp. n.**

(Figs. 68 and 182)

Resembling *apta* in form and general appearance but with distinct male genital structures. Length: 5 mm.

Crown produced and bluntly angled, two-thirds as long at middle as basal width between the eyes.

Color.—Crown and scutellum buff, pronotum and forewings green. Apical cells of forewings smoky, veins yellow.

Genitalia.—Female seventh sternum with lateral angles broadly rounded, posterior margin almost truncate, central third slightly excavated and broadly embrowned, appearing distinctly excavated. Male plates long, tapered, apices pointed, divergent, not extending to posterior spines. Style short, extending only onto base of plates. Anterior spines short, thick with a basal spur. Posterior spines rather thick, transverse, extending beyond middle of pygofer.

Holotype male.—Santa Rita Mts., Arizona, May 30, 1930, E. D. Ball. *Allotype female*.—Colorado, 1589, C. F. Baker. *Paratypes*.—3, 1 male, Sabina Canyon, Arizona, June 22, 1933, Oman; 2 females, same as allotype, marked 1563 and 1569. Holotype, allotype, and paratypes in the U. S. National Museum collection. Paratype in the DeLong collection.

***Ballana flexa* sp. n.**

(Figs. 55, 187, and 404)

Resembling *parallela* in form and general appearance but with distinct male genital structures. Length: 5.2 to 5.6 mm.

Crown bluntly angled, almost twice as wide between eyes at base as median length.

Color.—Pale greenish, often almost white, without definite color markings. Face and beneath pale.

Genitalia.—Female seventh sternum broadly, rather deeply excavated on median half between the produced, rounded lateral angles. The excavation is about one-fifth the distance to base. Male plates elongate, triangular, longer than pygofer; apices narrow and blunt. Styles short, extending about one-fourth the length of plates. Anterior spines only a very short spur. Posterior spines single, transverse, extending beyond the median line of pygofer.

Holotype male and allotype female.—White Sands, New Mexico, June 27, 1949, R. H. Beamer. *Paratypes*.—4 males, 3 females, same data as holotype and allotype; 2 males, 3 females, Oman, same as holotype except June 7, 1933; 43 females, 39 males, Jemez Springs, New Mexico, July 1, 1941, R. H. Beamer; 1 male, Belen, New Mexico, July 20, 1936, D. R. Lindsay. Holotype, allotype, and paratypes in the University of Kansas collection. Paratypes in the U. S. National Museum collection, the DeLong collection, and The Ohio State University collection.

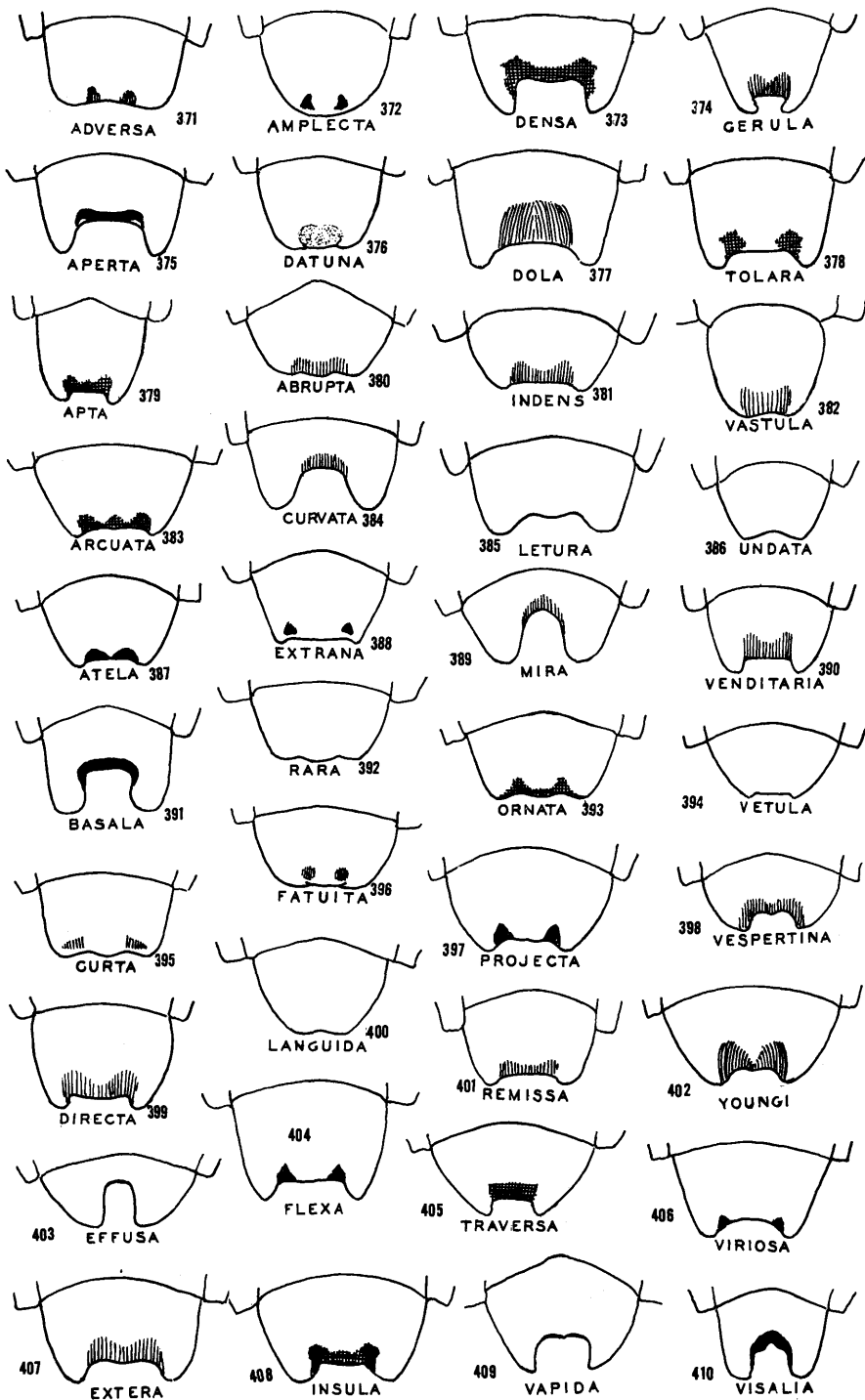
***Ballana mira* sp. n.**

(Figs. 87, 226, and 389)

Resembling *vastula* in form and appearance but with distinct male genital structures. Length: 4.5 mm.

Crown strongly produced and bluntly angled; almost as long at middle as basal width between eyes.

Color.—Crown yellowish, apical portion pale brownish. Pronotum and scutellum yellow tinged with green. Forewings green, apical cells smoky. Face and beneath pale brownish. Arcs on face darker.



FIGURES 371-410. Female seventh sternum of species as labeled.

Genitalia.—Female seventh sternum with rounded lateral angles between which the median half of posterior margin is deeply excavated forming a broad U-shaped notch which extends half way to base. Male plates elongate, apices rather broad and rounded. Styles rather long, extending beyond middle of plates. Anterior spines represented by a mere spur. Posterior spines single, abruptly bent, the apical half transverse, tapered to slender tips which extend to middle of pygofer.

Holotype male, allotype female, and 27 male and 8 female paratypes.—Dunsmuir, Calif., June 29, 1935, R. H. Beamer. Holotype, allotype, and paratypes in the University of Kansas collection. Paratypes in DeLong collection, U. S. National Museum collection, and The Ohio State University collection.

***Ballana curvata* sp. n.**

(Figs. 48, 203, and 384)

Resembling *elexa* in form and appearance but with distinct male genital structures. Length: 5.5 to 6 mm.

Crown produced and bluntly angled; about two-thirds as long as basal width.

Color.—Pale green; crown, pronotum, and scutellum tinged with yellow. Forewings with apical cells often smoky subhyaline.

Genitalia.—Female seventh sternum with broadly rounded lateral angles between which the median half of posterior margin is deeply, broadly excavated forming a broad U-shaped notch which extends half way to the base. Male plates rather broad, convexly rounded to broad rounded apices. Styles long, extending two-thirds the distance of plates. Anterior spines consisting of a rather short, heavy spur extending caudally and pointed. Posterior spines long, slender, curved caudally and inwardly, the apical third tapered and extending well beyond the median line.

Holotype male and allotype female.—Santa Cruz Mts., Calif., August 13, 1938, R. H. Beamer. *Paratypes*.—6 males, 10 females, same data as holotype and allotype; 9 females, 3 males, Salado Beach, Calif., July 1, 1933, R. H. Beamer. Holotype, allotype, and paratypes in the University of Kansas University collection. Paratypes in the DeLong collection and The Ohio State University collection.

Remarks.—This insect was collected from *Arctostaphylos tomentosa* Pur.

***Ballana undata* sp. n.**

(Figs. 54, 228, and 386)

Resembling *vastula* in form and appearance but with distinct male genital structures. Length: 5 mm.

Crown strongly produced and angled, a little wider between eyes at base than median length. Body slender.

Color.—Pale green; crown yellow, other parts tinged with yellow. Face dark, thoracic venter and ovipositor dark.

Genitalia.—Female seventh sternum with the posterior margin broadly and slightly concavely emarginate between the lateral angles. Male plates long, concavely rounded on outer margins to form slender pointed apices which do not quite extend to length of pygofer. Styles short, extending onto base of plates only. Anterior spines very short, only a thick spur. Posterior spines long, single, transverse. The apical half slender and tapered and extending beyond the median line of pygofer.

Holotype male, allotype female, 4 male paratypes, 1 female paratype.—El Portal, Cal., June 23, 1935, Oman. Holotype, allotype, and paratypes in U. S. National Museum collection. Paratypes in DeLong collection.

***Ballana delicata* sp. n.**

(Figs. 70 and 227)

Resembling *visalia* in form and appearance but with distinct male genital structures. Length: 5 mm.

Crown produced and bluntly angled, two-thirds as long at middle as basal width between the eyes.

Color.—Pale green tinted with yellow.

Genitalia.—Male plates long, concavely rounded on outer margins to form tapered, pointed apices. Styles short, extending onto base of plates only. Anterior spines very short, represented by a spur. Posterior spines very short, stout, extending caudally and bent inwardly, not extending to dorsal pygofer.

Holotype male and paratype male.—Los Angeles, Cal., April, C. F. Baker, A. Koebele collection. Both are in the U. S. National Museum collection.

***Ballana effusa* sp. n.**

(Figs. 86, 214, and 403)

A small, pointed headed species resembling *vastula* in form and general appearance but with distinct genital structures. Length: 4 to 4.2 mm.

Crown produced and angled, about as long at middle as basal width between the eyes.

Color.—Crown buff, washed with pale brown on the apical area. The arcs from face curving up onto crown. Pronotum, scutellum, and forewings green, apical cells of forewings smoky.

Genitalia.—Female seventh sternum with posterior margin convexly rounding from near base to middle fourth where it is abruptly excavated by a U-shaped excavation more than two-thirds the distance to base. The lateral angles are wanting. Male plates medium in size and triangular, apices broad and blunt. The pygofer are much wider and slightly longer than plates. Styles medium in length, extending to about middle of plates. Anterior spines represented by a mere spur. Posterior spines single, tapered to slender pointed apices; extending inwardly, the apical portion curved cephalad and beyond the median line.

Holotype male, allotype female, 13 male paratypes and a female paratype.—Dunsmuir, Cal., June 22, 1935, Oman. Holotype, allotype, and paratypes in U. S. National Museum collection. Male paratype in the University of Kansas collection and in the DeLong collection.

***Ballana fatuita* sp. n.**

(Figs. 63, 215, and 396)

Resembling *indens* in form and appearance but with distinct male genital structures. Length: 5 to 5.5 mm.

Crown bluntly angled, almost two-thirds as long at middle as basal width between the eyes.

Color.—Pale green, crown buff without markings.

Genitalia.—Female seventh sternum with posterior margin almost truncate. There is a slight notch each side of the median third. Male plates elongate with pointed apices, exceeded in width and length by the pygofer. Styles medium in length, extending to about half the length of the plates. Anterior spines very short, curved outwardly. Posterior spines with apical half transverse, extending beyond the median line of pygofer.

Holotype male, allotype female, 6 male paratypes and a female paratype.—Arimo, Ida., July 12, 1935, Oman. Holotype, allotype, and paratypes in the U. S. National Museum collection. Paratypes in the DeLong collection.

***Ballana absenta* DeLong**

(Figs. 98, 255, 276, and 333)

Ballana absenta DeLong, 1937: 113.

Resembling *calcara* in general form but paler in color and with distinct genitalia. Length: 5.5 mm.

Crown bluntly angled, almost twice as wide between eyes at base as length at middle, anterior margin thick.

Color.—Pale straw yellow, forewings slightly tinted with green.

Genitalia.—Female seventh sternum with lateral margins convexly rounding to form produced, angular lobes each side of a broad excavated central half, with truncated margin and

excavated about one-fourth the distance to the base. Male plates small, about as long as combined width at base, sides almost straight, apex blunt, rounded, not reaching posterior spines by about one-third their length. Styles short, extending on to base of plates only. Anterior spines entirely wanting. Posterior spines short, simple, curved inwardly and caudally on each side, not approximating the anal tube.

Type.—DeLong collection.

Remarks.—Described from specimens from Overton and Glendale, Nevada; St. George and Richfield, Utah. Specimens from Durango, Colorado, have been examined.

Ballana languida (Ball)

(Figs. 13, 99, 261, 277, and 400)

Thamnotettix languida Ball, 1902: 17.

A well marked species with blunt head and distinct male genital structures. Length: 5.5 to 6 mm.

Crown short and broad, scarcely produced, more than half as long at middle as basal width between eyes.

Color.—Male with crown, pronotum, scutellum, and clavus bright yellow. Arcs on face visible, from above, on crown. A row of six dark spots along anterior margin of pronotum. A large dark spot in each basal angle and a pair of proximal spots at center of scutellum. Forewing, except clavus, subhyaline with yellow veins. Female marked as male, except forewings, which may lack the yellow color of clavus, but the two claval veins are bright yellow.

Genitalia.—Female seventh sternum with the posterior margin broadly, convexly rounded from base with a slight broad notch at apex. Male plates elongate, convex on outer margins, apices bluntly pointed. Styles medium in length, extending to about the middle of the plates. Anterior spines missing; posterior spines thick at base, tapered to slender, pointed apices, directed caudally.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected in Los Angeles Co., California. Specimens from Ontario, California; and Kanab, Utah, have been examined.

Ballana atela sp. n.

(Figs. 78, 196, and 387)

Resembling *flexa* in form and general appearance but with distinct male genital structures. Length: 4.5 to 5 mm.

Crown rounded anteriorly, almost two-thirds as long at middle as basal width between the eyes.

Color.—Pale greenish, appearing white, unmarked.

Genitalia.—Female seventh sternum with rounded lateral angles between which the posterior margin is broadly and very shallowly excavated. Male plates elongate triangular, distinctly shorter than pygofer, apices pointed. Styles rather short, extending only to one-third the length of plates. Anterior spine short, thick, with a blunt apex, which is curved caudally. Posterior spines single, rather stout, almost transverse, curving slightly caudally to median line of anal tube.

Holotype male and allotype female.—Arlington, Oregon, July 15, 1931, R. H. Beamer. *Paratypes*.—2 males, Mint Canyon, Calif., June 7, 1935, Oman. Holotype, allotype, and paratype in the University of Kansas collection, paratype in the DeLong collection.

Ballana amplecta (DeLong)

(Figs. 50, 195, and 372)

Laevicephalus amplecta DeLong, 1935: 157.

A small species with a bluntly angled head, resembling *attenuata* in form and appearance but with distinct male genital structures. Length: 3.5 to 4 mm.

Crown produced and bluntly angled, more than three-fourths as long at middle as basal width between the eyes.

Color.—Greenish yellow, forewing subhyaline with yellow veins.

Genitalia.—Female seventh sternum without lateral angles, posterior margin produced from base on a strongly convexly curved margin bearing a conspicuous brown spot either side of middle. Male plates long, narrow and pointed, extending beyond posterior spines. Styles short, extending onto base of plates only. Anterior spines short, represented by a slender spur. Posterior spines short, slender, extended diagonally toward anal tube, reaching outer portion of dorsal pygofer.

Type.—DeLong collection.

Remarks.—Described from specimens from Edenvale, California. A male specimen from the National Museum is from Perris, California.

Ballana chiragrica (Ball)

(Figs. 83 and 192)

Thamnotettix chiragrica Ball, 1900: 337.

A blunt headed, well marked species resembling *calcara* in general form. Length: 5.5 to 6 mm.

Crown rather broad, rounded in front, more than twice as wide between eyes at base as median length.

Color.—Crown yellow, curved arcs from front visible from above; a pair of large square shaped brown spots on upper margin next each eye; often a faint spot at center of crown and a pair of round spots on the middle of each side at base. Pronotum yellow with a rather large spot behind each eye at lateral margin; irregular markings along anterior margin, often missing. Scutellum pale with a large brown triangular spot in each basal angle and usually a pair of small faint proximal spots at middle. Forewing brown with veins broadly white producing a conspicuous striped appearance.

Genitalia.—Female seventh sternum with lateral angles strongly produced and rounded, the central half of posterior margin abruptly broadly excavated about one-fourth the distance to base, the posterior margin of excavation broadly convexly rounded. Male plates rather short, convexly rounded to bluntly rounded apices, extending to posterior spines. Anterior spines short, transverse. Posterior spines arising near anterior spines, basal half transverse then curved caudally so that they cross each other.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from a single female specimen collected at Phoenix, Arizona. Specimens from the Santa Rita Mts., Congress Jct. and Globe, Arizona, have been examined.

Ballana spinosa DeLong

(Figs. 124, 165, 302, and 358)

Ballana spinosa DeLong, 1937: 110.

Resembling *atridorsum* in general appearance but with more bluntly angled crown and distinct genitalia. Length: 6 mm.

Crown very blunt, almost rounded in front, margin thick, rounding to front, almost twice as wide between eyes at base as length at middle.

Color.—Crown pale yellow; pronotum, scutellum and forewings dull greenish.

Genitalia.—Female seventh sternum with posterior margin indented on median half, forming a slightly sunken truncate lobe. Male plates short and broad, only slightly longer than combined basal width, convexly rounded to form broad, rounded apices which reach the junction of the posterior spines. Styles long, extending two-thirds the length of the plates. Anterior spines stout, medium in length, directed caudally and curved inwardly. Posterior spines long, extending inwardly and caudally beyond median line, straight, heavy at base tapered to pointed apices.

Type.—DeLong collection.

Remarks.—Described from specimens collected at Idaho City, Idaho.

Ballana parallela DeLong

(Figs. 127, 201, and 305)

Ballana parallela DeLong, 1937: 110.

Resembling *spinosa* in general appearance but with distinct male genitalia. Length: 5 mm.

Crown scarcely produced, rounded, almost half as long at middle as basal width between eyes, margin thick, bluntly angled with front.

Color.—Yellowish, forewings slightly tinged with dull green.

Genitalia.—Male plates a little longer than combined width at base, sides convexly rounded, apices blunt, rounded, reaching the posterior spines. Styles medium in length, extending to about the middle of plates. Anterior spines and posterior spines long, straight and heavy, both pairs extending obliquely caudally so that they appear parallel. The posterior spines meeting at median line.

Type.—DeLong collection.

Remarks.—Described from a male specimen collected at Twin Falls, Idaho.

Ballana chrysothamna (DeL & D)

(Figs. 129, 171, and 307)

Thamnotettix chrysothamna DeL & D, 1934: 222.

Resembling *calcara* in general form but with color markings and distinct male genital structures. Length: 5 mm.

Crown produced and blunt at apex, more than half as long at middle as basal width between eyes.

Color.—Crown, pronotum, and scutellum buff, pronotum usually gray on disc. Forewings brown with pale veins or brown with outer clavus paler causing a striped appearance.

Genitalia.—Female seventh sternum with posterior margin convexly rounded, the central third of segment abruptly excavated one-fourth the distance to base forming a broad U-shaped excavation, which is broadly bordered with brown at base. Male plates convexly rounded on outer margins to blunt apices; plates not as long as pygofer. Styles long, extending about two-thirds the length of plates. Anterior spines rather short and thick, extending to posterior spines. Posterior spines arising close to anterior spines, rather thick, transverse, reaching median line.

Type.—DeLong collection.

Remarks.—Described from specimens from Minidoka, Idaho, and other Idaho localities. One specimen collected by Dr. R. W. Haegele at Bruneare, Idaho, is labelled *S. vermiculatus*, indicating the plant from which it was taken. Specimens at hand are from Richfield, Idaho, labelled rabbit brush.

Ballana polica DeLong

(Figs. 126, 183, 306, and 328)

Ballana polica DeLong, 1937: 110.

Resembling *spinosa* in general form and appearance but with distinct genitalia. Length: 5.5 mm.

Crown blunt, scarcely produced at middle, twice as wide between eyes at base as length at middle, margin thick, almost rounded to front.

Color.—Crown cream colored; pronotum, scutellum, and forewings pale, dull green.

Genitalia.—Female seventh sternum with lateral angled rounded, median third of posterior margin indented, concavely rounded. Male plates about as long as combined basal width, sides almost straight, apices rather broad and blunt, reaching the posterior spines. Styles medium in length, extending to middle of plates. Anterior spines medium in length, thick, extending caudally and curved inwardly at apex. Posterior spines heavy, apices pointed and meeting at median line, almost transverse, apices curved caudally.

Type.—DeLong collection.

Remarks.—Described from specimens from Craters of the Moon and Aberdeen, Idaho.

Specimens from Montezuma County, Arizona, have been examined which are apparently this species.

Ballana quira DeLong

(Figs. 128, 173, 304, and 329)

Ballana quira DeLong, 1937: 109.

In form and general appearance resembling *atridorsum* but with distinct genitalia. Length: 5 to 5.5 mm.

Margin of crown thick, crown bluntly angled, more than one-half wider between eyes at base than length at middle.

Color.—Crown, anterior margin of pronotum and scutellum yellowish. Disc of pronotum and forewings dull yellowish green.

Genitalia.—Female seventh sternum strongly convexly rounding from about half its length to almost truncate posterior margin, the central third of which is slightly indented but truncate. Male plates about as long as combined basal width, sides almost straight, apices bluntly pointed, not reaching to posterior spines. Styles medium in length, extending about one-third the length of the plates. Anterior spines short, rather thick, tapered to a pointed apex, extending inwardly and caudally. Posterior spines appearing parallel to anterior spines, longer, heavy, directed inwardly and caudally, not reaching median line of pygofer.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at Sunset Park, Arizona. Additional specimens studied are from Maybell, Berthoud Pass, Craig, and Durango, Colorado; Flagstaff, Arizona; Floy and Timpec, Utah.

Ballana coarcta DeLong

(Figs. 130, 164, 309, and 332)

Ballana coarcta DeLong, 1937: 113.

Resembling *callida* in general appearance but with blunter crown and distinct genitalia. Length: 5 mm.

Crown strongly produced, apex bluntly angled, one-fourth wider between eyes at base than median length.

Color.—Crown and scutellum yellowish, forewings and disc of pronotum dull greenish, apex of forewings black.

Genitalia.—Female seventh sternum decidedly narrowed to posterior margin which is broadly, shallowly emarginate more than half its width. Male plates long and slender, longer than combined basal width, sides concave, apices bluntly pointed, almost reaching to posterior spines. Styles short, extending about one-fourth the length of plates. Anterior spines rather short and thick with a short basal spur. Posterior spines arising near anterior spines, short, heavy, sloping obliquely caudally, not reaching median line.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at Alpine, California.

Ballana knulli sp. n.

(Figs. 16, 71, and 211)

A small blunt-headed species resembling *amplecta* in form and appearance but with distinct genital structures. Length: 4.4 mm.

Crown produced and blunt, three-fourths as long at middle as basal width between eyes.

Color.—Crown and scutellum dull yellowish, pronotum and forewings gray green with yellow veins.

Genitalia.—Female seventh sternum with posterior margin broadly, slightly convexly rounded. Male plates long, tapered, bluntly pointed, as long as pygofer. Styles short, extending onto base of plates. Anterior spines short, single, consisting of only a spur. Posterior spines arising with anterior spines and extending caudad to anal tube on either side of plates.

Holotype male and allotype female.—Pinon Flat, Santa Rosa M., Cal., July 1, 1941, D. J. and J. N. Knull. *Paratype*.—1 male, same data as holotype; 1 male, Campo, Cal., June 18, 1941, D. J. and J. N. Knull. Holotype, allotype, and paratypes in DeLong collection.

***Ballana clara* sp. n.**

(Figs. 46 and 184)

Resembling *basala* in form and appearance but with distinct male genital structures. Length: 6 mm.

Crown produced, blunt at apex, more than half as long at middle as basal width between eyes.

Color.—Dull yellow, crown and scutellum more buff.

Genitalia.—Female seventh sternum with lateral angles rounded to posterior margin which is deeply, squarely excavated on median fourth to one third the distance to base. Male plates with outer margins convexly rounded to blunt apices. Pygofer exceeding plates by more than one-half their length. Styles medium in length, extending beyond middle of plates. Anterior spines short, single and rather robust. Posterior spines single, sloping caudally almost to tip of anal tube; rather robust and reaching about to center line of pygofer.

Holotype male, allotype female, male and female paratypes.—Hualpai Mt., Ariz., July 4, 1937, D. J. and J. N. Knull. Holotype and paratype in the DeLong collection.

***Ballana orleta* sp. n.**

(Figs. 75 and 213)

Resembling *parallela* in form and general appearance but with more markings on crown and with distinct male genitalia. Length: 5 mm.

Crown with anterior margin broadly rounded, length at middle a little more than half of the basal width between the eyes.

Color.—Pale dull green. Crown with reflexed arcs from face on each side of middle, the ocelli and a small spot at each side of apex, brown; otherwise without definite markings.

Genitalia.—Male plates triangular, as long as pygofer with pointed apices. Styles median in length, extending to about half the length of the plates. Anterior spines single, medium in length, thick at base and tapered to slender apices. Posterior spines single, stout, sloping inwardly and caudally meeting at anal tube, extending to median line.

Holotype male.—Mt. Shasta, Calif., June 29, 1935, R. H. Beamer, in the University of Kansas collection.

***Ballana remissa* sp. n.**

(Figs. 84, 200, and 401)

Resembling *flexa* in form and general appearance but with distinct male genital structures. Length: 4.5 to 5 mm.

Crown rather broadly rounded anteriorly, two-thirds as long at middle as basal width between eyes.

Color.—Pale green, appearing white, unmarked.

Genitalia.—Female seventh sternum with the posterior margin broadly, shallowly excavated on median half between the slightly produced, rounded lateral angles. Male plates elongate triangular, exceeded in length by the pygofer, apices pointed. Styles rather short, extending onto basal third of plates. Anterior spines very short, thick at base, apex narrowed and pointed caudally. Posterior spines single with apical portion transverse and curved cephalad at tips, extending beyond median line.

Holotype male and allotype female.—Moser Lake, Washington, July 20, 1949, R. H. Beamer. *Paratypes*.—2 males, 2 females, same data as holotype and allotype; 1 male, 19 females, Arlington, Oregon, July 15, 1931, R. H. Beamer. Holotype, allotype, and paratypes in the University of Kansas collection. Paratypes in the U. S. National Museum, the DeLong collection, and The Ohio State University collection.

Ballana vetula (Ball)

(Figs. 3, 93, 252, 271, and 394)

Thamnotettix atridorsum var. *vetula* Ball, 1910: 302.

A broad headed yellow species with distinct male genital structures. Length: 5 mm.

Crown produced and blunt at apex, more than half as long at middle as basal width between eyes.

Color.—Cream yellow without markings.*Genitalia*.—Female seventh sternum with posterior margin broadly, rather shallowly excavated on median half, the posterior margin of excavation convexly rounded. Male plates short, triangular, outer margins convexly rounded, not extending to posterior spines. Styles medium in length, reaching to about the middle of plates. Anterior spines represented by a tiny plate. Posterior spines short, thick, transverse, posterior to anal tube, reaching about half the distance to the median line.*Type*.—Ball collection, U. S. National Museum.*Remarks*.—Described from specimens from Kelso, California, and from American Fork, Utah.*Ballana valga* DeLong

(Figs. 146, 243, 317, and 334)

Ballana valga DeLong, 1937: 116.Resembling *pleura* in form but with pale yellow color and distinct genitalia. Length: 5 mm.

Crown bluntly angled, only slightly produced, one and two-thirds times as wide between eyes at base as median length, margin thick.

Color.—Pale yellowish without definite markings, veins pale.*Genitalia*.—Female seventh sternum with lateral margins strongly convexly rounding from base to posterior margin which is shallowly, evenly, and rather broadly concave. Male plates as long as combined basal width, side margins slightly concavely rounded to form bluntly pointed apices which do not reach the posterior spines by about one-fourth their length. Styles short, extending onto basal fourth of plates. Anterior spines very short, extending caudally and outwardly. Posterior spines thick, bent, the apical half transverse, tapered abruptly at apex, not reaching median line.*Type*.—Ball collection, U. S. National Museum.*Remarks*.—Described from specimens collected at Provo, Utah.*Ballana datuna* sp. n.

(Figs. 67, 225, and 376)

Resembling *callida* in form and appearance but with distinct male genital structures. Length: 4.5 to 5 mm.

Crown produced and bluntly angled, almost as long at middle as basal width between eyes.

Color.—Crown, pronotum, and scutellum yellow, tinged with green. Forewings green with yellow veins. Beneath yellowish unmarked.*Genitalia*.—Female seventh sternum with median third of the posterior margin slightly broadly excavated, the center of which is broadly convexly curved forming a broad, sunken lobe. The posterior margin therefore appears trilobate. Male plates elongate triangular with blunt tips, as long as pygofer. Styles short with only their apices extending on to base of plates. Anterior spines short, thick, apex pointed and extending caudally. Posterior spines thick at base, apical portion slender and transverse, extending beyond median line of pygofer.*Holotype male, allotype female, and male paratype*.—Criterion, Oregon, July 2, 1935, R. H. Beamer. Holotype and allotype, in University of Kansas collection. Paratype in the DeLong collection.

Ballana ortha DeLong

(Figs. 94, 250, 272, and 337)

Ballana ortha DeLong, 1937: 111.

Resembling *spinosa* in form and general appearance but with distinct male genitalia. Length: 5.5 mm.

Crown produced and rounded at apex, margin very thick, rounded to front, about twice as wide between eyes at base as length at middle.

Color.—Crown and scutellum yellowish, pronotum and forewings dull green.

Genitalia.—Female seventh sternum with central half of posterior margin roundedly produced forming a broad, truncated lobe which is heavily black margined and more caudal than remainder of segment. Male plates not quite as long as combined basal width, triangular, gradually narrowed to bluntly pointed apices which do not reach to the branches of the posterior spines. Styles rather long, extending beyond the middle of the plates. Anterior spines represented by a small plate bearing a spur. Posterior spines long, straight, extending obliquely caudally to anal tube.

Type.—DeLong collection.

Remarks.—Described from specimens collected at Logan Canyon, Cove Fort, and Dixie, Utah; Minidoka and Bliss, Idaho; and Overton, Nevada. Other specimens examined are from Kanab, Utah; Hot Springs, Wheatland, Sloss, Masonville, and Mishawanka, Colorado; Cloudcraft, New Mexico; Medora and Mandan, North Dakota; Quatay and Idyllwild, California.

Ballana aperta sp. n.

(Figs. 101, 262, and 375)

Resembling *polica* in form and appearance but with distinct genital structures. Length: 5 mm.

Crown broad, rounded anteriorly, more than half as long at middle as basal width between eyes.

Color.—Crown, pronotum, and scutellum yellow; pronotum tinged with green. Forewings pale green. Face yellow with faint arcs.

Genitalia.—Female seventh sternum with rounded lateral angles between which the median half of posterior margin is deeply, broadly excavated almost half way to base. Male plates broad, apices bent, extending almost to length of pygofer. Styles rather long extending beyond the middle of the plates. Anterior spines very short and thick. Posterior spines straight, rather short, tapered to slender apices, sloping medially and caudally almost to median line of pygofer.

The male genital structures are similar to those of *ortha* but the female seventh sternum is entirely different in the two species.

Holotype male, allotype female, and 3 female paratypes.—Deeth, Nevada, July 31, 1947, R. H. Beamer. Holotype, allotype, and paratypes in the University of Kansas collection. Female paratype in DeLong collection.

Ballana calcea DeLong

(Figs. 90, 237, 269, and 344)

Ballana calcea DeLong, 1937: 106.

Resembling *atridorsum* in general appearance but smaller and with distinct genitalia. Length: 5 mm.

Crown bluntly angled, length at middle more than half basal width between eyes, margin of crown thick.

Color.—Pale green, crown yellowish green.

Genitalia.—Female seventh sternum with lateral margins convexly rounding to form broadly rounded lobes between which the central third of the posterior margin is slightly excavated. The posterior margin of the excavation slightly convexly rounded. Male plates long, slightly longer than combined basal width, sides almost straight, apices blunt, rounded, reaching almost to posterior spines. Styles short, extending onto base of plates only. Anterior spines repre-

sented by a heavy chitinized protrusion. Posterior spines heavy at base, tapered to slender pointed apices; almost transverse, sloping slightly caudally, not reaching anal tube.

Type.—DeLong collection.

Remarks.—Described from specimens collected at Bunkersville, Nevada; Glendale, Nevada, from *Hymenoclea salsola*; Mesquite, Nevada, from *Franseria eriocentra*.

Ballana hebea DeLong

(Figs. 88, 245, 325, and 341)

Ballana hebea DeLong, 1937: 112.

Resembling *calcara* in form and size but with distinct genitalia. Length: 5 mm.

Crown bluntly angled, more than half as long on middle as basal width between eyes, margin thick.

Color.—Pale, dirty yellow; forewings slightly tinged with green. Veins pale, conspicuous.

Genitalia.—Female seventh sternum with lateral margins convexly rounding to form rounded lobes of posterior margin between which the median third is distinctly abruptly excavated, the apex of which is truncated. Male plates a little longer than combined basal width, appearing long, sides almost straight, apices blunt, slightly longer than distance to posterior spines. Styles medium in length but not reaching to middle of plates. Anterior spines short, represented by a spur from a basal plate. Posterior spines arising near anterior spines; short, stout, extending obliquely caudally, not reaching median line.

Type.—DeLong collection.

Remarks.—Described from specimens from Benjamin, Brigham, N. Payson, Richfield, Utah; and Ely and Elko, Nevada. Specimens from Cisco, Utah; and Kerniwick, Washington; and Loveland, Colorado; have also been examined.

Ballana mera DeLong

(Figs. 147, 256, 267, and 359)

Ballana mera DeLong, 1937: 109.

Resembling *filamenta* in general form and appearance but with crown more bluntly angled and with distinct genitalia. Length: 5.5 mm.

Crown produced and bluntly angled, one and one-third times as wide between eyes at base as length at middle.

Color.—Crown yellow; pronotum, scutellum, and forewings green washed with yellow, veins paler.

Genitalia.—Female seventh sternum with lateral margins convexly rounded from about half its length to posterior margin which is truncate at middle. Male plates not quite as long as combined basal width, convexly rounded to broadly rounded apices which do not reach posterior spines by more than one-third their length. Styles long, extending two-thirds the distance of plates. Anterior spines represented by a chitinized plate with two tiny spurs protruding from it. Posterior spines heavy at base, tapered to pointed apices; bent at about middle, the apical half transverse, not reaching the median line.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at Muir Woods, California. Specimens have been examined from Lockwood, Stinson Beach, Lucerne, and Alameda Co., California; and Phoenix, Arizona.

Ballana brevidens DeLong

(Figs. 89, 246, 268, and 343)

Ballana brevidens DeLong, 1937: 106.

Resembling *atridorsum* in general form and appearance but with distinct genitalia. Length: 5.5 mm.

Crown slightly produced, bluntly angled, bluntly angled with front, twice as wide between eyes at base as length at middle.

Color.—Yellowish, forewings very pale, dull green, apices of forewings slightly smoky.

Genitalia.—Female seventh sternum with lateral angles broadly rounded to median third of posterior margin which is indented, almost truncate and black margined. Male plates about as long as combined width at base, sides almost straight, apices bluntly pointed, just reaching the posterior spines. Styles medium in length, not extending to the middle of the plates. Anterior spines represented by a spur arising from a heavily chitinized plate. Posterior spines single, rather short, extending inwardly and caudally, but not reaching anal tube.

Types.—DeLong collection.

Remarks.—Described from specimens collected at Minidoka, Idaho.

Ballana brevidens subspecies *curta* subsp. n.

(Figs. 79, 223, and 395)

A blunt headed species resembling *parallela* in form and appearance but with distinct male genital structures. Length: 6 mm.

Crown produced and blunt at apex, more than half as long as basal width between the eyes.

Color.—Crown and scutellum yellow, pronotum and forewings pale dull green.

Genitalia.—Female seventh sternum almost truncate, slightly convex at center of posterior margin, causing the posterior margin to appear slightly trilobate. Male plates as long as pygofer, concavely rounded on outer margins to form rather slender apices, which are pointed. Styles very short, extending on base of plates only. Anterior spines very short and bifid. Posterior spines single, short, stout, not extending to middle line of pygofer.

Holotype male.—Dixie Nat. Forest, Nev., July 1, 1937, D. J. and J. N. Knull. *Allotype female*.—Same data as holotype. *Paratypes*.—4 males, same data as holotype; 8 males, 13 females, Hualpai Mts., Ariz., July 4, 1937, D. J. and J. N. Knull; 1 male, 2 females, Dixie Nat. Forest, Nev., July 1, 1937, J. N. Knull; 1 male, 1 female, Hualpai Mts., Ariz., August 6, 1938, D. J. and J. N. Knull; 14 males, 6 females, Escondido, Cal., July 15, 1941, R. H. Beamer; 11 males, 18 females, Flagstaff, Ariz., July 27, 1938, August 5, 1933, August 1, 1933, R. H. Beamer; 11 males, 10 females, Alpine, Cal., July 9, 1929, R. H. Beamer; 1 male, 1 female, Miramar, Cal., July 28, 1938, R. H. Beamer; 9 males, 12 females, Mesa Verde, Colo., July 13, 1927, R. H. Beamer; 6 males, 6 females, Laguna Mts., Calif., July 6, 1929, R. H. Beamer; 10 males, 16 females, Oak Creek Canyon, Ariz., July 9, 1942, R. H. Beamer; Williams, Arizona, August 9, 1938, D. J. and J. N. Knull. Holotype, allotype, and paratypes in the DeLong collection. Paratypes in the University of Kansas collection, The Ohio State University collection, and the U. S. National Museum collection.

Remarks.—The Miramar specimens were collected from *Integrifolia rhus* B & W.

Ballana elexa DeLong

(Figs. 96, 254, 273, and 348)

Ballana elexa DeLong, 1937: 108.

Resembling *firma* in general appearance and coloration but with distinct genitalia. Length 5 mm.

Crown bluntly angled, margin of crown thick, one-third wider between eyes at base than length at middle.

Color.—Crown, anterior margin of pronotum, and scutellum yellowish; disc of pronotum and forewings yellowish green, veins paler, apices of forewings dusky to brown.

Genitalia.—Female seventh sternum convexly rounded from near base to form posterior margin which is almost truncate, slightly indented either side of median third. Male plates about as long as combined basal width, side margins almost straight, apices broad, bluntly pointed on inner margin, not reaching to posterior spines. Styles medium in length, not extending to middle of plates. Anterior spines represented by a short, heavily chitinized plate. Posterior spines arising near this plate, directed caudally and sloping inwardly, not reaching anal tube; heavy, with pointed apices.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at Pine Valley, California. Specimens from Granite Dell, Phoenix, Oak Creek Canyon, Arizona; and Jacumba, California, have been examined.

Ballana calcara DeLong

(Figs. 97, 253, 275, and 347)

Ballana calcara DeLong, 1937: 111.Resembling *spinosa* in general form but with distinct genitalia. Length: 5.5 mm.

Crown bluntly angled, almost half as long at middle as basal width between eyes; margin thick.

Color.—Crown and pronotum yellow, scutellum pale green, forewings rather bright green.*Genitalia*.—Female seventh sternum with lateral margins produced almost straight from base to broadly curved outer lobes of posterior margin between which the central third is rather deeply, broadly excavated, the apical truncated margin of which is broadly embrowned. Male plates as long as combined basal width, convexly rounded to blunt apices, reaching only about two thirds the distance to the posterior spines. Styles long, extending more than half the length of the plates. Anterior spines represented by a heavily chitinized plate only. Posterior spines heavy, sloping obliquely caudally to tip of anal tube, sharp pointed at apex.*Type*.—DeLong collection.*Remarks*.—Described from specimens collected at Dunphy, Nevada, from *Chrysothamnus* sp.*Ballana tiaja* DeLong

(Figs. 2, 95, 251, 274, and 370)

Ballana tiaja DeLong, 1937: 116.Resembling *vetula* in general appearance and coloration but larger and with distinct genitalia. Length: 5.5 to 6 mm.

Crown broadly rounded, one and one-half times as wide between eyes at base as median length, margin thick, bluntly angled with front.

Color.—White to pale yellow, disc of pronotum and forewings appearing gray.*Genitalia*.—Female seventh sternum narrowed to bluntly rounded lateral angles between which the posterior margin is slightly excavated and the margin is slightly convexly rounded. Male plates about as long as combined basal width, broadly triangular, apices broad, blunt, rounded, not reaching to posterior spines. Styles short, extending to about one-fourth the length of the plates. Anterior spines represented by a slight chitinized plate. Posterior spines directed caudally and bent inwardly, caudal to the anal tube.*Type*.—Ball collection, U. S. National Museum.*Remarks*.—Described from specimens collected at Tia Juana, Mexico. Other specimens have been examined from Ti Juana, Mexico; Yuma and Pheonix, Arizona.*Ballana plena* DeLong

(Figs. 92, 249, 326, and 336)

Ballana plena DeLong, 1937: 114.Resembling *sera* in general appearance but with broader head and distinct genitalia. Length: 5.5 to 6 mm.

Crown very broadly, bluntly angled, margin thick, slightly more than one and one-half times as wide at base as median length.

Color.—Crown, anterior margin of pronotum, and scutellum yellow; brownish arcs of front extending up onto anterior margin of crown. Disc of pronotum and forewings green washed with yellow, veins of wing paler.*Genitalia*.—Female seventh sternum with lateral margins convexly rounding from near base to posterior margin which is broadly V-shaped, notched at center, about one-third the distance to base. Apex of notch broadly black. Male plates as long as combined basal width, sides slightly convexly rounded, obliquely sloping to blunt apices, not reaching posterior spines. Styles long, extending to two-thirds the length of plates. Anterior spine represented by a small chitinized plate. Posterior spines long, rather heavy, obliquely, caudally sloping toward anal tube but not extending to it.*Type*.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at Pine Valley, California. Other specimens have been examined from Mt. Springs, Boulevard, San Jacinto, Palmdale, Laguna Mt., Mohave, Mt. Diable, and Warner Springs, California.

Ballana occidentalis DeLong

(Figs. 91, 248, and 270)

Ballana occidentalis DeLong, 1937: 112.

Resembling *calcara* in form and general appearance but with crown more blunt and with distinct genitalia. Length: 5.5 mm.

Crown bluntly angled, not more than one-half broader between eyes at base than length at middle.

Color.—Crown yellow; pronotum, scutellum and forewings pale, dull green, apices of forewings smoky.

Genitalia.—Male plates together slightly broader than long, lateral margins convexly rounded, apices blunt, rounded, extending only about two-thirds the distance to posterior spines. Styles medium in length, extending to about middle of plates. Anterior spines represented by a heavily chitinized plate only. Posterior spines heavy, rather long, sloping obliquely caudally to anal tube, not reaching median line.

Type.—DeLong collection.

Remarks.—Described from specimens from Elko, Nevada, from *Chrysothamnus*. Specimens from Pagosa Springs, Colorado, have been examined.

Ballana letura sp. n.

(Figs. 65, 185, and 385)

A blunt headed species related to *calcea* but differing from it by distinct male genital structures. Length: 5 to 5.5 mm.

Crown bluntly angled, about two-thirds as long at middle as basal width between eyes.

Color.—Crown and scutellum yellow, pronotum and forewings greenish yellow.

Genitalia.—Female seventh sternum with broadly rounded lateral angles between which the median half of posterior margin is broadly, rather shallowly excavated. Male plates short, broad, apices bluntly rounded; greatly exceeded in length by pygofer, styles short, slender. Anterior spines short, scarcely produced, bifid. Posterior spines single, long, transverse, each extending beyond middle.

Holotype male and allotype female.—Gila Bend, Arizona, April 13, 1933, E. D. Ball. *Paratypes.*—20 males, 11 females, same data as holotype; 10 males, 5 females, Sabina Canyon, Arizona, April 19, 1940, P. Oman. Holotype, allotype, and paratypes in Ball collection, U. S. National Museum. Paratypes in the University of Kansas collection, DeLong collection, and The Ohio State University collection.

Ballana luxuria sp. n.

(Figs. 69 and 188)

Resembling *quira* in form and appearance with distinct male genital structures. Length: 6 mm.

Crown produced, blunt at apex, more than half as long at middle as basal width between eyes.

Color.—Yellowish green, crown and scutellum predominantly yellow.

Genitalia.—Male plates broad, triangular with bluntly angled apices, as long as pygofer. Styles rather long and narrow, reaching to two-thirds the length of the plates. Anterior spines very short, represented by a short spur only. Posterior spines single, rather long, slightly curved caudally and extending beyond middle of pygofer, crossing near apices.

Holotype male.—Mt. Springs, San Diego Co., Cal. (desert at R. R. stop) June 11, 1915, Harold Morrison. Holotype in the DeLong collection.

***Ballana dola* sp. n.**

(Figs. 51, 191, and 337)

Resembling *chrysothama* in form and general appearance but with distinct male genital structures. Length: 5.5 mm.

Crown bluntly angled, almost rounded, almost twice as wide between eyes at base as median length.

Color.—Pale green with apical portion of forewing darker. Crown and scutellum often yellow. Face pale with faint arcs. Beneath pale.

Genitalia.—Female seventh sternum with posterior margin broadly and distinctly excavated between the rounded, produced lateral angles. Male plates triangular with blunt apices, exceeded in length by pygofer. Styles long, extending to two-thirds the length of plates. Anterior spines replaced by a short, thick plate. Posterior spines long, single, curved inwardly and caudally to anal tube where they cross.

Holotype male and allotype female.—Elko, Nevada, July 30, 1947. *Paratypes*.—15 males, 21 females, same data as holotype; 19 males, 24 females, Jenez Springs, New Mexico, July 1, 1941. Holotype, allotype, and paratype in University of Kansas collection. Paratypes in DeLong collection.

***Ballana insula* sp. n.**

(Figs. 85, 220, and 408)

Resembling *indens* in form and general appearance but with distinct male genital structures. Length: 5 to 6 mm.

Crown produced and bluntly angled, two-thirds as long as basal width between eyes.

Color.—Pale gray-green, tinged with yellow. Crown usually entirely yellow or buff.

Genitalia.—Female seventh sternum with lateral angles rounded, posterior margin rather broadly, shallowly excavated on median third, about one-fourth the distance to base. Male plates triangular, apices blunt, exceeded in width and length by the pygofer. Styles medium in length, extending to about the middle of plates. Anterior spines very short, represented by a heavy spur. Posterior spines rather thick, tapered to a pointed apex, transverse, reaching beyond the median line of pygofer.

Holotype male.—Phoenix, Arizona, April 1, 1930. *Allotype female*.—Same locality, April 12, 1936, E. D. Ball. *Paratypes*.—33, all from Phoenix; 2 males, same as holotype; 16 males and 15 females, same as allotype.

Holotype and paratypes in the DeLong collection. Allotype and paratypes in the U. S. National Museum collection. Paratypes in the University of Kansas collection.

***Ballana traversa* sp. n.**

(Figs. 77, 190, and 405)

Resembling *quira* in form and appearance but with distinct male genital structures. Length: 5.5 to 6 mm.

Crown produced and bluntly angled, about two-thirds as long at middle as basal width between eyes.

Color.—Crown and scutellum buff, pronotum and forewings pale green.

Genitalia.—Female seventh sternum with lateral angles produced, broad and rounded, posterior margin abruptly excavated on the median third, about one-fifth distance to base. Male plates long, length of pygofer, outer margins convexly rounded, apices blunt. Styles long and slender, more than two-thirds as long as plates. Anterior spines short, single, thickened at base, slender at apex. Posterior spines long, single, transverse, extending beyond median line of pygofer.

Holotype male and allotype female.—Montezuma Co., Colo., July 26, 1938, D. J. and J. N. Knull. *Paratypes*.—8 males, 12 females, same data as holotype; 3 males, 3 females, La Jolla, Cal., July 18, 1941, R. H. Beamer; 1 male, Lompoc, Cal., August 6, 1938, R. H. Beamer; 1 male, July 13, 1941, Burt Hogden. Holotype, allotype, and paratypes in the DeLong collection, paratypes in the U. S. National Museum collection, the University of Kansas collection, and The Ohio State University collection.

***Ballana arcuata* sp. n.**

(Figs. 49, 205, and 383)

A blunt headed species resembling *occidentalis* in form and appearance but with distinct male genital structures. Length: 5 to 5.5 mm.

Crown almost transverse, scarcely produced at middle, about half as long at middle as basal width between eyes.

Color.—Crown yellow with the arcs from face visible from above on margin; scutellum yellow. Pronotum and forewings pale green tinged with yellow. Face pale with dark arcs.

Genitalia.—Female seventh sternum with a truncate posterior margin which is bordered with dark coloration. Male plates tapered to pointed apices; greatly exceeded in length by the posterior pygofer spines. Styles short, only slightly extended onto base of plates. Anterior spines very short, thick. Posterior spines long, curved inwardly, apices transverse and extending beyond middle of pygofer.

Holotype male and allotype female.—Williams, Ariz., July 9, 1938, D. J. and J. N. Knull. *Paratypes*.—17 males, 11 females, same data as holotype; 1 male, Ash Fork, Ariz., July 18, 1929, E. D. Ball; 7 males, 2 females, Flagstaff, Ariz., June 23, 1937, D. J. and J. N. Knull; 6 males, 7 females, Williams, Ariz., July 13, 1929, E. D. Ball; 5 females, Flagstaff, Ariz., July 30, 1938, D. J. and J. N. Knull; 5 males, 2 females, Williams, Ariz., July 2, 1939, D. J. and J. N. Knull; 1 male, 2 females, Williams, Ariz., July 3, 1950, R. H. Beamer; 13 males, 13 females, Coconino Co., Ariz., August 13, 1927, R. H. Beamer; 12 males, 1 female, Flagstaff, Ariz., August 5, 1933, R. H. Beamer. Holotype, allotype, and paratypes in the DeLong collection, paratypes in the University of Kansas collection, the National Museum collection, and The Ohio State University collection.

***Ballana pleura* DeLong**

(Figs. 100, 260, 278, and 340)

Ballana pleura DeLong, 1937: 115.

Resembling *atridorsum* in general form and appearance but with distinct genitalia. Length: 5 to 5.5 mm.

Crown produced and bluntly angled, one and one-half times as wide between eyes at base as median length.

Color.—Male crown and scutellum yellow, pronotum and forewings green, veins paler, apices of forewings smoky. Female yellowish washed with brown, veins pale.

Genitalia.—Female seventh sternum with lateral margins strongly, convexly rounded from base to posterior margin which is truncated on central third and slightly indented. Male plates about as long as combined width, concavely rounded on outer margins to form pointed apices, which do not reach to the posterior spines. Styles short, extending only onto base of plates. Anterior spine represented by a chitinized plate. Posterior spines short, thick at base, concavely narrowed on apical half. Extended along margin of pygofer, directed caudally, not approaching median line.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at Santa Margarita, California.

***Ballana visalia* (Ball)**

(Figs. 6, 135, 159, 313, and 410)

Thamnotettix visalia Ball, 1910: 301.

A pale green species with a produced head, a bluntly angled crown, and with distinct male genital structures. Length: 5 mm.

Crown produced, bluntly angled, more than three-fourths as long as basal width between eyes.

Color.—Crown and scutellum yellow, pronotum pale green bordered with yellow; forewings dull pale green.

Genitalia.—Female seventh sternum with middle fourth of posterior margin deeply excavated, almost half way to base, the excavation U-shaped, with a notch at apex. Male plates

elongate, triangular, with pointed apices, extending beyond posterior spines. Styles medium in length, extending to middle of plates. Anterior spines composed of two spurs which cross each other; one is projected caudally and one directed inwardly. Posterior spines transverse, crossing each other and each extending well beyond median line.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at Chino and Visalia, California. Specimens from Mt. St. Helena, California, have been examined.

Ballana adversa DeLong

(Figs. 133, 170, 311, and 371)

Ballana adversa DeLong, 1937: 107.

Resembling *atridorsum* in general form and appearance but smaller and with distinct male genitalia. Length: 4.5 mm.

Crown produced and bluntly angled, two-thirds as long at middle as basal width between eyes, margin thick and bluntly angled with front.

Color.—Yellowish, pronotum and forewings tinged with green, apices of forewings slightly smoky.

Genitalia.—Male plates long, extending to length of pygofer, outer margins slightly concave, tapered to pointed apices. Styles medium in length but not reaching to middle of plates, due to their length. Anterior spines represented by two spurs from each side. One each side transverse and crossed by a more basal, shorter spine, which extends caudally. Posterior spines heavy at base, tapered to pointed apices which extend almost to middle and slope slightly cephalad.

Type.—DeLong collection.

Remarks.—Described from specimens collected at Stansburg I. Park and Santa Clara, Utah. Specimens have been examined from Albuquerque, Estancia, Jemez Springs, Moriarty, Mountain Park, Tajique, and Vaughn, New Mexico; Flagstaff, Williams, St. Johns, Grand Canyon, Santa Catalina Mts., Arizona; and Ti Juana, California.

Ballana transea DeLong

(Figs. 132, 172, 310, and 331)

Ballana transea DeLong, 1937: 106.

Resembling *atridorsum* in general appearance but with crown more produced and with distinct male genitalia. Length: 5 mm.

Crown produced and bluntly angled, margin thick, bluntly angled with front, about one-third wider between eyes at base than length at middle.

Color.—Crown, pronotum and scutellum yellowish; forewings dull green.

Genitalia.—Female seventh sternum short, posterior margin practically truncate, scarcely indented, central two-thirds broadly dark margined. Male plates about as long as combined basal width, sides almost straight, apices bluntly pointed, reaching to posterior spines. Styles medium in length, not extending to middle of plates. Anterior spines with two spurs arising from the chitinized plates which cross each other. These are short, the longer spine is directed laterally, the shorter spine is directed caudally. The posterior spines extend inwardly and slope slightly caudally. They are heavy at base and taper to slender, pointed apices which do not reach the dorsal portion of the pygofer.

Type.—DeLong collection.

Remarks.—Described from specimens from Colorado without specific data.

Ballana nigridens DeLong

(Figs. 125, 166, 303, and 327)

Ballana nigridens DeLong, 1937: 109.

Resembling *atridorsum* in general appearance but with crown blunter and with distinct genitalia. Length: 6.5 mm.

Crown bluntly angled, margin thick, bluntly angled with front, more than twice as wide between eyes at base as length at middle.

Color.—Crown yellow, pronotum dull green, anterior margin yellowish. Forewings dull greenish, apices slightly smoky, arcs on face pale brown, slightly visible from above.

Genitalia.—Female seventh sternum strongly produced and narrowed, posterior margin broadly, slightly indented forming a slightly rounded median lobe. Male plates rather long, almost one-fourth longer than combined width at base, apices bluntly pointed, not reaching end of anal tube. Styles medium in length, extending about one-third the length of the plates. Anterior spines composed of an elongated plate with a short spine arising at base and a longer one at apex. Posterior spine heavy to near apex, pointed, extending inwardly and caudally almost to anal tube.

Type.—DeLong collection.

Remarks.—Described from specimens collected at Jemez Springs, N. M.

***Ballana basala* sp. n.**

(Figs. 74, 193, and 391)

A pale, blunt headed species resembling *indens* in form and general appearance but with distinct male genital structures. Length: 5.5 to 6 mm.

Crown broad, bluntly angled, about two-thirds as long at middle as basal width between the eyes.

Color.—Pale green tinged with yellow; crown, pronotum, and scutellum may appear buff.

Genitalia.—Female seventh sternum with produced, broadly rounded lateral angles. The median third of posterior margin abruptly excavated forming a broad U-shaped notch which extends more than one-third the distance to base. Male plates broad, short, convexly rounded to bluntly pointed apices, exceeded in length by pygofer. Styles long and narrow, extending beyond middle of plates. Anterior spines short and slender with an inner apical spur. Posterior spines long, slender, single, curved inwardly beyond middle of pygofer.

Holotype and allotype.—Walsenburg, Colorado, July 7, 1938, D. J. and J. N. Knull. *Paratypes*.—17 males, 18 females, same as holotype; 2 males, 2 females, Lupton, Arizona, August 28, 1934, E. D. Ball; 5 males, 6 females, Grand Canyon, Arizona, July 28, 1936, R. H. Beamer; 5 males, 5 females, St. Johns, Arizona, July 26, 1936, R. H. Beamer; 2 males, 5 females, Santa Fe, New Mexico, July 20, 1936, R. H. Beamer; 2 males, 1 female, Taos Co., New Mexico, August 20, 1927, R. H. Beamer; 1 male, Painted Desert, Arizona, August 29, 1934, E. D. Ball; 1 male, 3 females, Flagstaff, Arizona, June 30, 1933. Holotype, allotype, and paratypes in the DeLong collection. Paratypes in the U. S. National Museum collection, the University of Kansas collection, and The Ohio State University collection.

***Ballana delta* sp. n.**

(Figs. 80 and 204)

Resembling *hebea* in form and appearance but with distinct male genital structures. Length: 5.5 mm.

Crown broad and rather short, about half as long at middle as basal width between the eyes.

Color.—Crown and scutellum buff; pronotum and forewings light green.

Genitalia.—Male plates tapered from base to narrow, sharp pointed apices, greatly exceeded by pygofer. Styles very short, only slightly extended onto base of plate. Anterior spines slender, medium in length. Posterior spines rather long, curved inwardly, apices transverse, extending to anal tube.

Holotype male.—Santa Fe, New Mexico, July 11, 1941, D. J. and J. N. Knull. Holotype in the DeLong collection.

***Ballana delea* DeLong**

(Figs. 119, 169, 297, and 349)

Ballana delea DeLong, 1937: 105.

Resembling *atridorsum* but with distinct genitalia. Length: 5 mm.

Crown produced, bluntly angled, and bluntly angled with front, about one-third wider between eyes at base than length at middle.

Color.—Crown, pronotum, and scutellum greenish yellow. Forewing green, apices hyaline.

Genitalia.—Female seventh sternum with lateral angles rounded, posterior margin between these slightly indented, forming a broad median sunken truncated portion. Male plates broad, only slightly longer than combined basal width, strongly convexly rounded to bluntly pointed apices which do not reach to the posterior spines. Styles medium in length, extending to almost half the length of plates. Anterior and posterior spines arising at almost the same length of the pygofer. Anterior spines, crossing posterior spines, rather heavy, directed caudally. Posterior spines long, stout, directed inwardly and caudally and extending beyond anal tube.

Type.—DeLong collection.

Remarks.—Described from Santa Barbara, California, specimens. Holotype and allotype in DeLong collection.

Ballana firma DeLong

(Figs. 120, 161, 298, and 361)

Ballana firma DeLong, 1937: 107.

In form and general appearance resembling *atridorsum* but with distinct genitalia. Length: 5 mm.

Crown produced but bluntly angled and bluntly angled with front. One-fifth wider between eyes at base than length at middle.

Color.—Crown, anterior margin of pronotum and scutellum yellow, disc of crown and forewings dark green, veins paler. Apices of forewings black to anterior cross veins of inner and outer apical cells.

Genitalia.—Female seventh sternum convexly rounded from near base to posterior margin which is deeply concavely rounded between these two pointed lobe-like portions. Male plates a little longer than combined basal width, side margins convexly rounded to bluntly pointed apices which reach beyond the posterior spines. Styles short, extending on to the base of plates only. Anterior spines stout, with pointed tips and extending caudally. They cross the posterior spines near their bases. Posterior spines extending inwardly and caudally, reaching to median line of pygofer. These spines are slender and tapered to apices.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at Alpine, California. Specimens from the San Jacinto Mts., California, have been examined.

Ballana filamenta DeLong

(Figs. 121, 167, 299, and 364)

Ballana filamenta DeLong, 1937: 108.

Resembling *attenuata* in form and general appearance but with blunter head and distinct genitalia. Length: 6 to 6.5 mm.

Crown well produced and rather sharply angled, acutely angled with front, one-half wider between eyes at base than median length.

Color.—Crown and anterior portion of pronotum yellow; disc of pronotum, scutellum and forewings green. Veins of forewings pale, apices subhyaline.

Genitalia.—Female seventh sternum with lateral margins slightly narrowed and produced, posterior margin forming two broadly rounding lobes between which is a broad U-shaped notch extending two-thirds the distance to base and broadly black margined at apex. Male plates a little longer than combined basal width, at least one-third as wide at apex as base, apices broadly rounded, not reaching posterior spines. Styles long, extending more than three-fourths the length of plates. Anterior spines long and slender, extending caudally beyond the posterior spines. Posterior spines heavy at base, abruptly narrowed at half their length, tapered and pointed, transverse, not extending to median line.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens from Yosemite and Santa Margarita, California. Other specimens from Jacinta, Cajon, Paynes Creek, Three Rivers, and Keen Camp, California, have been examined.

Ballana attenuata DeLong

(Figs. 122, 207, and 301)

Ballana attenuata DeLong, 1937: 108.Resembling *vivata* in general appearance but with distinct genitalia. Length: 5 mm.

Crown strongly produced and bluntly angled, bluntly angled with front, one-fourth wider between eyes at base than length at middle.

Color.—Crown and scutellum yellow, pronotum and forewings green washed with yellow, veins indistinct except at apex where they are pale on a slightly smoky, subhyaline apical portion.*Genitalia*.—Female seventh sternum with produced, broadly rounded lateral angles between which the median half of posterior margin is deeply excavated, half the distance to base in the form of a broad V-shaped notch. The apex is bordered with black. Male plates as long as combined basal width, more than half as broad at apex as width at base, apices broadly rounded, reaching posterior spines. Styles long, extending more than two-thirds the length of plates. Anterior spines long and slender, directed caudally and extending beyond posterior spines. Posterior spines short, thick at base, rapidly tapered to slender pointed apices which do not extend to median line of pygofer.*Type*.—Ball collection, U. S. National Museum.*Remarks*.—Described from a single male specimen collected at Pine Valley, California. Additional specimens have been examined from Pine Valley, Quatay, Lucerne, Monterey, Idyllwild, Lockwood, Jacumba, Victorville, Warner Springs, and Newton, California.*Ballana apta* sp. n.

(Figs. 72, 222, and 379)

Resembling *vastula* in form and general appearance but with distinct male genital structures. Length: 5.5 to 6 mm.

Crown strongly produced and angled; a little wider between eyes at base than median length.

Color.—Pale green; crown, pronotum, and scutellum tinted with yellow.*Genitalia*.—Female seventh sternum with lateral angles rounded, between which the posterior margin is broadly, shallowly excavated on median half. Male plates rather short, triangular, almost as long as pygofer. Styles medium in length, extending to almost half the length of plates. Anterior spines long, single, extending caudally beyond posterior spines and curved outwardly at apex. Posterior spines transverse, short, single, not extending to median line, with a spur arising on inner margin at base.*Holotype male*.—La Mesa, S. Diego Co., Cal., April 21, 1898, L. O. Howard. *Allotype female*.—Paynes Cr., Cal., June 27, 1935, Oman. *Paratypes*.—5 males, Henshaw Dam, Cal., June 3, 1935, Oman; 18 males, 10 females, Del Mar, Cal., June 2, 1935, Oman; 1 female, Sequoia Nat. Forest, Cal., June 10, 1935, Cold Springs, Cal., Oman. Holotype, allotype, and paratypes in U. S. National Museum. Paratype in the University of Kansas collection, the DeLong collection, and The Ohio State University collection.*Ballana vastula* (Ball)

(Figs. 1, 118, 178, 296, and 382)

Thamnotettix vastula Ball, 1910: 268.

A green species with a produced and angled head, black wing tips and distinct male genital structures. Length: 5.5 mm.

Crown produced and bluntly angled, more than three-fourths as long at middle as basal width between eyes.

Color.—Crown cream, scutellum yellow, pronotum cream tinged with green. Forewings green, apical cells black.*Genitalia*.—Female seventh sternum with posterior margin broadly and shallowly emarginate on middle half. Male plates very long and slender with pointed apices, extending to posterior spines. Styles very short, extending onto base of plates only. Anterior spines

rather long, thick, extending caudally. Posterior spines curving transversely, tapered and extending to median line.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens from Chico and Salinas, California. Specimens are at hand from San. L. Obispo, Santa Rosa, and Occidental, California.

Ballana prava DeLong

(Figs. 123, 163, and 300)

Ballana prava DeLong, 1937: 107.

In form and general appearance resembling *firma* but more slender, with crown more produced and with distinct male genitalia. Length: 5 mm.

Crown produced and bluntly angled, almost one-half wider between eyes at base than length at middle.

Color.—Crown yellow; pronotum, scutellum and forewings green. Apices of forewings black as far forward as cross veins of apical cells.

Genitalia.—Male plates not quite as long as combined basal width, triangular, sides almost straight, apices pointed, not reaching posterior spines by about one-third their length. Styles short, extending about one-third the length of plates. Anterior spines long, directed caudally on each side of dorsal portion of pygofer almost to posterior spines. Posterior spines single, transverse, heavy, with pointed apices which reach to median line of pygofer.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at San Luis Obispo, California.

Ballana abrupta sp. n.

(Figs. 59, 212, 314, and 380)

Resembling *ipis* in form and appearance but with distinct male genital structures. Length: 5.5 to 6 mm.

Crown produced and bluntly angled, a little wider between eyes at base than median length.

Color.—Pale green, crown pale yellow, pronotum yellow anteriorly, scutellum tinged with yellow.

Genitalia.—Female seventh sternum with posterior margin broadly, only slightly excavated on middle third, forming a slightly sunken lobe. Male plates rather narrow, elongate, with blunt apices, distinctly shorter than pygofer. Styles short, extending to the basal fourth of plates. Anterior spines single, long, curved inwardly, then caudally at apex. The posterior spines are short, thick, curved inwardly to anal tube and dorsally, the apices proximal.

Holotype male, allotype female, 10 male and 15 female paratypes.—Cuyamaca Lake, Calif., July 6, 1929, R. H. Beamer. Holotype, allotype, and paratypes in the University of Kansas collection. Paratypes in the U. S. National Museum, the DeLong collections, and The Ohio State University collection.

Ballana mana DeLong

(Figs. 102, 264, 280, and 345)

Ballana mana DeLong, 1937: 119.

Resembling *seca* in form and general appearance but with distinct genitalia. Length: 5 to 5.5 mm.

Crown broadly rounded, almost twice as wide between eyes at base as median length. Margin thick, rounded to front.

Color.—Crown and scutellum dull yellow, pronotum and forewings dull greenish.

Genitalia.—Female seventh sternum with side margins sloping and narrowed to posterior margin which is broadly, squarely emarginate one-fourth the distance to base. Male plates short, not as long as combined basal width, sides convexly rounded, apices rather broad, bluntly rounded, not reaching posterior spines by at least half their length. Styles medium in length, not extending to middle of plates. Anterior spines short, thick, with one or two spurs arising at base. Posterior spines thick, rather long, extending caudally and inwardly,

caudad to anal tube. Enlarged at apex and forming a hand-like structure with the projecting spines representing fingers.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at Mojave, California. Specimens from Lafayette, San Margarita, Pasadena, Chilcoat, Beaumont, La Mesa, California; and Monroe, Utah, have been examined.

Ballana antlera DeLong

(Figs. 104, 265, 282, and 355)

Ballana antlera DeLong, 1937: 120.

Resembling *velosa* in form and general appearance but with distinct male genitalia. Length: 5 mm.

Crown bluntly angled, not quite twice as wide between eyes at base as length at middle. Margin thick.

Color.—Crown, scutellum, and anterior portion of pronotum yellow; part of pronotum and forewings dull green.

Genitalia.—Female seventh sternum with lateral margins strongly convexly rounding to form outer rounded lobes between which the posterior margin is broadly excavated about one-fourth the distance to the base. Male plates about as long as combined basal width, sides almost straight, apices broad and bluntly rounded, almost one-third their basal width, not reaching posterior spines by about one-fourth their length. Styles medium in length, not extending to middle of plates. Anterior spines short, extending caudally with a pair of pointed spurs. Posterior spines heavy with a series of three or more spurs arising on cephalad margin; apex slender, pointed, reaching to anal tube.

Type.—DeLong collection.

Remarks.—Described from specimens collected at Murtaugh, Idaho. Specimens from Mint Canyon, California, have been examined.

Ballana telora sp. n.

(Figs. 53 and 186)

Resembling *parallela* in general form and appearance but with distinct male genitalia. Length: 5.5 mm.

Crown rounded in front, more than two-thirds as long at middle as basal width between eyes.

Color.—Pale green.

Genitalia.—Male plates triangular with blunt apices, definitely exceeded by pygofer. Styles medium in length, extending almost half the length of the plates. Anterior spines very short and thick with pointed caudally curved apices. Posterior spines single, tapered to slender apices, straight and extended medially and cephalad beyond the median line of pygofer.

Holotype male.—Austin, Nevada, August 12, 1940, R. H. Beamer, is located in the University of Kansas collection.

Ballana ornata sp. n.

(Figs. 76, 216, and 393)

Resembling *extrana* in form and appearance but with distinct male genital structures. Length: 5 to 5.5 mm.

Crown produced and bluntly angled, more than two-thirds as long at middle as basal width between eyes.

Color.—Crown and scutellum buff, pronotum and forewings light green washed with yellow.

Genitalia.—Female seventh sternum with posterior margin slightly notched each side of median third so that the margin appears slightly trilobate. A dark spot at each notch emphasizes this condition. Male plates elongate, triangular, about as long as pygofer, gradually tapered to blunt apices. Styles short, extending only about one-third the length of the plates. Anterior spines wanting. Posterior spines simple with a spine-like spur at base, then rapidly tapered to slender pointed tips. These are angled caudally and touch the anal tube.

Holotype male, allotype female, 5 male paratypes, and 1 female paratype.—Oak Creek Canyon, Ariz., August 1, 1938, D. J. and J. N. Knull. Holotype, allotype, and paratypes in the DeLong collection. Paratype female in the U. S. National Museum collection and in the University of Kansas collection.

***Ballana extera* sp. n.**

(Figs. 73, 219, and 407)

Resembling *polica* in form and appearance but with distinct male genital structures. Length: 5 mm.

Crown broad, scarcely produced, margin broadly rounded; slightly more than half as long at middle as basal width between the eyes.

Color.—Crown yellow, pronotum and scutellum yellow tinged with green. Forewings pale green. Arcs of face faintly visible on anterior margin of crown.

Genitalia.—Female seventh sternum with lateral angles rather well produced and rounded, between which the median half of posterior margin is broadly, rather strongly excavated one-fourth the distance to base. Male plates broad and short, apices divergent and blunt, definitely shorter than pygofer. Styles short, extending to one-third the length of plates. Anterior spines short, curved caudally, tapered to slender apices. Posterior spines curved medially with apices slender, extending to median line and with a spur arising on anterior margin at about the middle.

Holotype male, female allotype, 19 male paratypes, and 12 female paratypes.—Kerby, Oregon, July 15, 1935, R. H. Beamer. Holotype, allotype, and paratypes in the University of Kansas collection. Paratype in DeLong collection.

***Ballana convergens* sp. n.**

(Figs. 18, 57, and 206)

Resembling *vapida* in form and general appearance but with distinct male genital structures. Length: 5.5 to 6 mm.

Crown produced and bluntly angled, two-thirds as long at middle as basal width between eyes.

Color.—Crown buff with a few faint darker markings, usually a pair of small dark spots at base and arcs on front visible from above. Pronotum usually brown with buff anterior margin. Forewings brown; face buff with brown arcs.

Genitalia.—Female seventh sternum with produced, rounded lateral angles. Median half of posterior margin broadly deeply excavated more than one-third the distance to base. Male plates broad, as long as pygofer, apices blunt. Styles medium in length, not reaching to middle of plates. Anterior spines medium in length, single, with a lateral spur. Posterior spines long, single, with a lateral spur. All four spines bent toward each other and converging.

Holotype male and allotype female.—Pinon Flat, Santa Rosa M., Calif., July 1, 1941, D. J. and J. N. Knull. *Paratypes.*—8 males, 8 females, same data as holotype and allotype; 1 female, Baldwin Lk., Cal., June 27, 1941, D. J. and J. N. Knull. Holotype, allotype, and paratypes in the DeLong collection. Paratypes in the U. S. National Museum collection and the University of Kansas collection.

***Ballana aris* DeLong**

(Figs. 105, 162, 283, and 352)

Ballana aris DeLong, 1937: 120.

Resembling *velosa* in form and general appearance but with distinct genitalia. Length: 5 mm.

Crown bluntly angled, not quite as wide between eyes at base as length at middle. Margin thick.

Color.—Dull green, crown and scutellum yellowish.

Genitalia.—Female seventh sternum with lateral margins obliquely sloping to form bluntly rounded lobes between which the posterior margin is broadly excavated about one-fourth the distance to base. Male plates not quite as long as combined basal width, sides almost straight,

apices bluntly pointed, not reaching to posterior spines. Styles rather short, extending about one-third the length of plates. Anterior spines represented by a small chitinized plate with protruding points. Posterior spines extending caudally and inwardly to caudal end of anal tube, bifid at apex, terminating in a longer posterior spur and a shorter anterior spur.

Type.—DeLong collection.

Remarks.—Described from specimens from Rosette, Utah; and Kelsaw Canyon, Idaho. Other specimens examined are from Monravia, Big Bear Lake, Tahachapi, Jacumba, and Victorville, California.

***Ballana cerea* sp. n.**

(Figs. 81 and 229)

Resembling *diutia* in form and appearance but with distinct male genital structures. Length: 5 mm.

Crown broad, rounded anteriorly, more than half as long at middle as basal width between the eyes.

Color.—Pale greenish, appearing white.

Genitalia.—Male plates broad, triangular with narrow pointed tips. Styles short, extending onto base of plates only. Anterior spine consisting of a very short spur. Posterior spines single, transverse, thick, with abruptly narrowed apices which extend beyond median line.

Holotype male.—Cove Fort, Utah, August 14, 1929, R. H. Beamer. *Paratypes*.—1 male, St. George, Utah, June 10, 1928, E. W. Davis; 1 male, Douglas Co., Kansas, May 29, 1929, P. B. Lawson (at trap light). Holotype and paratype in the University of Kansas collection. Paratype male in the DeLong collection.

***Ballana dena* DeLong**

(Figs. 108, 259, and 287)

Ballana dena DeLong, 1937: 120.

In form and general appearance resembling *velosa* but with distinct genitalia. Length: 5 mm.

Crown bluntly angled, not quite as wide between eyes at base as length at middle.

Color.—Dull grayish green, unmarked.

Genitalia.—Male plates not as long as combined width at base, apices more than two-thirds the width at base, blunt, broadly rounded, almost truncate. Styles long, extending more than two-thirds the length of plates. Anterior spines represented by a tiny spur. Posterior spines extending inwardly to median line and slightly caudally. Bifid at apex; terminating with a longer posterior spur and a shorted anterior spur.

Type.—DeLong collection.

Remarks.—Described from a male specimen from Santa Barbara, California. Specimens from Topango Canyon, Diablo, and Brea, California, have been examined.

***Ballana extrana* sp. n.**

(Figs. 82, 210, and 388)

Resembling *apta* in form and general appearance but with distinct male genital structures. Length: 5.5 mm.

Crown produced and bluntly angled, more than two-thirds as long at middle as basal width between eyes.

Color.—Light green tinged with yellow.

Genitalia.—Female seventh sternum with posterior margin almost truncate, median half very slightly, broadly, shallowly excavated. Male plates long, tapered to pointed apices, extending to posterior spines. Styles short, extending onto plates at base. Anterior spines very short, bifid. Posterior spines transverse, bifid at tip, not extending to middle of pygofer.

Holotype male.—Granite Dell, July 29, 1934, E. D. Ball. *Allotype female*.—Granite Dell, Arizona, July 17, 1929, E. D. Ball. *Paratypes*.—1 male, same data as allotype; 1 male, 1 female, Williams, Arizona, August 15, 1929, E. D. Ball. Holotype, allotype, and paratype in the U. S. National Museum collection. Paratypes in the DeLong collection.

Ballana seca DeLong

(Figs. 103, 257, 281, and 357)

Ballana seca DeLong, 1937: 118.

Resembling *cuna* in form and general appearance but with distinct genitalia. Length: 5.5 to 6 mm.

Crown broadly rounded, almost twice as wide between eyes at base as median length. Margin thick, rounded to front.

Color.—Crown and scutellum yellowish, pronotum and forewings dull green, veins pale.

Genitalia.—Female seventh sternum narrowed to posterior margin which is broadly rather squarely excavated on median half. Male plates not quite as long as combined basal width, apices rather broad, bluntly pointed, not reaching posterior spines by about one-third their length. Styles medium in length, extending to about half the length of plates. Anterior spines represented by small chitinized plates. Posterior spines rather short and thick, broadened at apex, blunt, with a short spine protruding on the outer and inner apical edge.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at Lebec, California. Other specimens from Mohava, California, have been examined.

Ballana profusa sp. n.

(Figs. 58 and 199)

A blunt headed species resembling *spinosa* in form and appearance but with distinct male genital structures. Length: 5 mm.

Crown produced and almost rounded, more than half as long at middle as basal width between eyes.

Color.—Crown buff tinged with green; pronotum, scutellum, and forewings pale green.

Genitalia.—Male plates elongate, triangular, with blunt apices, well exceeded in length by pygofer. Styles medium in length extending half the length of plates. Anterior spines short, stout, with a minute spur at base. Posterior spines stout, rather short, extending to median line of pygofer, short spine-like spur at about middle on inner margin.

Holotype male and paratype male.—Carey, Idaho, July 8, 1938, B. F. Coon. The holotype and paratype are in the DeLong collection.

Remarks.—These specimens were collected from rabbit brush.

Ballana velosa DeLong

(Figs. 14, 106, 258, and 284)

Ballana velosa DeLong, 1937: 119.

Resembling *bicornis* in general appearance but with distinct male genitalia. Length: 5 mm.

Crown bluntly angled, not quite twice as wide between eyes at base as length at middle, margin thick.

Color.—Crown, pronotum, and scutellum pale yellow; disc of pronotum dark green. Forewings dark green, apices subhyaline.

Genitalia.—Male plates slightly longer than basal width, side margins slightly, convexly rounded, apices bluntly rounded, not reaching posterior spines by about one-fourth their length. Styles short, extending onto base of plate only. Anterior spines represented by a chitinized plate and two projecting spurs. Posterior spines thick, transverse, not reaching median line, apex blunt, bearing a short spur on the anterior and posterior margins.

Type.—DeLong collection.

Remarks.—Described from specimens collected at Murtaugh, Idaho.

Ballana vespertina (Ball)

(Figs. 12, 107, 263, 285, and 398)

Thamnotettix vespertina Ball, 1910: 301.

A green species with a bluntly angled head and with distinct male genital structures. Length: 6 mm.

Crown produced and bluntly angled, about two-thirds as long at middle as basal width between eyes.

Color.—Crown and scutellum yellow, pronotum dull green bordered with yellow. Forewings pale, dull green.

Genitalia.—Female seventh sternum with posterior margin broadly and shallowly excavated on median half. Male plates rather broad, triangular, outer margins convexly rounded, apices divergent, pointed. Styles medium in length, extending beyond middle of plates. Anterior spines rather long, thick, directed caudally almost to posterior spines. Posterior spines almost transverse, heavy throughout, bifid at tip only, extending almost to median line.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at Beaumont, California.

Ballana calipera DeLong

(Figs. 115, 153, 295, and 342)

Ballana calipera DeLong, 1937: 121.

Resembling *velosa* in form and general appearance but with distinct male genitalia. Length: 6 mm.

Crown bluntly angled, not quite twice as wide between eyes at base as length at middle.

Color.—Crown, pronotum, and scutellum yellow; disc of pronotum and forewings dark green.

Genitalia.—Female seventh sternum with lateral margins strongly convexly rounding to posterior margin which has a rounded outer lobe either side of a central half which is excavated one-fifth the distance to the base, the central portion of which is gently convexly rounded. Male plates about as long as combined basal width, apices blunt, rounded, not reaching posterior spines by about one-fourth their length. Styles medium in length, extending to about one-third the length of plates. Anterior spines short, thick, extending caudally. Posterior spines heavy, transverse, bifid on apical half, the arms reaching to about median line.

Type.—DeLong collection.

Remarks.—Described from specimens collected at Logan Canyon, St. George, Utah; Tahoe National Park, Colfax, California; Craters of the Moon, Idaho; and Glendale, Overton, Nevada. Other specimens examined are from Bozeman, Montana; Republic Grand Coulee, Washington; Logan Canyon, Utah; El Portal and Mt. Diablo, California.

Ballana bicornis DeLong

(Figs. 117, 154, 294, and 350)

Ballana bicornis DeLong, 1937: 119.

Resembling *atridorsum* in general appearance, bright green with distinct male genitalia. Length: 5.5 mm.

Crown broad, bluntly angled, about one-third wider between eyes at base than length at middle.

Color.—Crown, pronotum, and scutellum yellow; disc of pronotum green. Forewings bright green, veins paler.

Genitalia.—Female seventh sternum narrowed to apical margin which is broadly roundedly, almost squarely excavated one-fifth the distance to base. Male plates about equal in length to combined basal width, side margins slightly convexly rounded, apices bluntly pointed, not reaching posterior spines. Styles medium in length, extending to about one-third the length of plates. Anterior spines short, extending caudally, the apices directed outwardly. Posterior spines extending caudally and inwardly to anal tube; bifid, cleft more than half way to base, terminal pieces heavy, equal in length.

Type.—DeLong collection.

Remarks.—Described from specimens from Logan, Sardine Canyon, Utah; Nampa, Idaho; Santa Margarita and Yosemite, California. Specimens from Smithfield, Utah; and D'Aste, Montana; have been examined.

***Ballana volsella* sp. n.**

(Figs. 43 and 197)

Resembling *arma* in form and appearance but with distinct male genital structures. Length: 5.5 mm.

Crown with anterior margin rounded between eyes, two-thirds as long at middle as basal width between the eyes.

Color.—Pale greenish, crown yellow. Forewings smoky at apex.

Genitalia.—Male plates rather narrow and short, triangular, apices pointed. The pygofer is much wider and longer than plates. Styles short, extending onto base of plates only. Anterior spines single, medium in length, extending caudally and with slender apices, curved outwardly. Posterior spines bifid near base, the anterior arm shorter than the posterior arm.

Holotype male and 3 paratype males.—Mt. Shasta, Cal., June 29, 1935, Oman. Holotype and paratypes in the U. S. National Museum collection. Male paratype in the DeLong collection.

***Ballana cuna* DeLong**

(Figs. 25, 36, 160, and 360)

Ballana cuna DeLong, 1937: 118.

Resembling *ortha* in form and general appearance but with head even more blunt and with distinct genitalia. Length: 5 to 5.5 mm.

Crown very blunt, almost rounded in front, almost twice as wide between eyes at base as length at middle, margin of crown thick.

Color.—Crown yellow; pronotum, scutellum and forewings tinged with yellow, veins of forewings paler.

Genitalia.—Female seventh sternum with lateral margins sloping and posterior margin narrowed, sinuate, a narrow U-shaped notch at center. Male plates as long as combined width at base, sides slightly convexly rounded, apices bluntly pointed, not reaching to posterior spines. Styles medium in length, extending to about the middle of plates. Anterior spines long, slender, extending caudally beyond posterior spines which are transverse, bifid, cleft almost to base. The separated terminal arms are heavy. The caudal two are longer than the cephalad portions.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at Weed, California. Specimens from Dorris and Bray, California, have been examined.

***Ballana bifida* DeLong**

(Figs. 109, 148, 286, and 369)

Ballana bifida DeLong, 1937: 117.

Resembling *titusi* but with crown more bluntly angled and with distinct genital structures. Length: 4.5 mm.

Crown bluntly angled, about one-fourth wider between eyes at base than length at middle. wings dark green, venation pale, apices subhyaline.

Genitalia.—Female seventh sternum with lateral margins rounded to form outer rounded lobes of posterior margin between which the central third is broadly shallowly emarginate. Male plates long and narrow, a little longer than combined width at base, sides slightly concave, apices bluntly pointed reaching the posterior spines. Styles short, extending about one-fourth the length of plates. Anterior spines short, thick at base, pointed. Posterior spines transverse, bifid on apical half, reaching median line.

Type.—DeLong collection.

Remarks.—Described from specimens collected at Craters of the Moon, Idaho City, and Murtaugh, Idaho. Specimens from Pine Valley and Campo, California; and Oak Creek Canyon, Arizona; have been examined.

Ballana callida DeLong

(Figs. 110, 149, 288, and 362)

Ballana callida DeLong, 1937: 121.

Resembling *chelata* in form and general appearance but with distinct genitalia. Length: 5 to 5.5 mm.

Crown strongly produced and angled, about one-fifth wider between eyes at base than length at middle and acutely angled with face.

Color.—Crown yellowish; pronotum, scutellum and forewings green tinged with yellow. Forewings with apical cells black.

Genitalia.—Female seventh sternum with side margins sloping, narrowed to posterior margin which is broadly squarely and rather shallowly excavated two-thirds its width. Male plates about as long as combined width at base, sides straight, apices bluntly pointed, not reaching to posterior spines. Styles short, extending about one-fifth the length of plates. Anterior spines very short, composed of two proximal spurs. Posterior spines short, heavy, almost transverse, cleft and bifid on apical portion, the two arms proximal.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at Riverside and Alpine, California.

Ballana ipis sp. n.

(Figs. 114, 232, and 292)

Resembling *vastula* in form and appearance but with distinct male genital structures. Length: 6 mm.

Crown produced and angled, almost as long at middle as basal width between eyes.

Color.—Crown cream, scutellum yellow, pronotum green, forewings green, apical portion smoky; brown arcs of face visible from above as they extend onto margin.

Genitalia.—Female seventh sternum with lateral angles broadly rounded, posterior margin truncate, central half broadly bordered with brown pigment, appearing excavated. Male plates long, extending to posterior spines, triangular with acutely pointed apices. Styles short, extending to one-fourth the length of plates. Anterior spines short, curved dorsally and caudally. Posterior spines bifid, cleft more than half way to base, ventral arm shorter than dorsal arm.

Holotype male and allotype female.—Yosemite, California, June 29, 1938, E. D. Ball. *Paratypes*.—1 male, 1 female, same data as holotype; 1 male, Santa Cruz Mt., Calif., August 13, 1938, R. H. Beamer. Holotype, allotype and paratype in Ball collection, U. S. National Museum. Paratype in University of Kansas collection and in the DeLong collection.

Ballana dira DeLong

(Figs. 116, 151, 293, and 356)

Ballana dira DeLong, 1937: 118.

Resembling *attenuata* in general form but pale in color and with distinct genitalia. Length: 5.5 to 6 mm.

Crown rather sharply angled, one-third wider between eyes at base than median length, rather sharply angled with front.

Color.—Crown and scutellum yellowish, pronotum and forewings rather pale, dull green.

Genitalia.—Female seventh sternum sloping from base to narrowed posterior margin which is rather squarely, broadly and shallowly excavated on median half, base of excavation black margined. Male plates as long as combined width at base, sides convexly rounded, apices broad, bluntly rounded, almost reaching to posterior spines. Styles medium in length, extending to about the middle of plates. Anterior spines rather short, thick, extending caudally. Posterior spines transverse, bifid, cleft more than half way to base, apical portions rather thick and pointed.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at Tucson and Ajo Mts., Ariz. Other specimens examined are from Tucson and Santa Catalina Mts., Arizona; and Lake Tahoe, California.

***Ballana projecta* sp. n.**

(Figs. 64, 218, and 397)

Resembling *basala* in form and appearance but with distinct male genital structures. Length: 5 to 6 mm.

Crown produced, blunt at apex, half as long at middle as basal width between eyes.

Color.—Crown and scutellum buff, pronotum and forewings white to gray.

Genitalia.—Female seventh sternum with broadly, rounded lateral angles between which the central third of the posterior margin is broadly, abruptly excavated forming a broad U-shaped cavity about one-fifth the distance to base. Male plates long, as long as pygofer, outer margins slightly concave, apices bluntly pointed. Styles rather short, not reaching to middle of plates. Anterior spines single, rather long, sloping caudally and extending to middle line of pygofer. Posterior spines with a spur arising on caudal margin not far from apex and causing the spine to appear bifid.

Holotype male, allotype female, 2 male paratypes and 2 female paratypes.—Wickenburg, Ariz., June 16, 1937, D. J. and J. N. Knull. Holotype, allotype, and paratypes in DeLong collection. Paratypes in the U. S. National Museum collection.

***Ballana titusi* (Ball)**

(Figs. 10, 111, 266, 289, and 365)

Thamnotettix titusi Ball, 1910: 267.

A slender green species with pointed head and distinct genitalia. Length: 5.5 to 6 mm.

Crown produced and pointed, more than two-thirds as long at middle as basal width between eyes.

Color.—Crown and scutellum yellow, pronotum green tinged with yellow, forewings green apices smoky, subhyaline.

Genitalia.—Female seventh sternum sloping to posterior margin which is truncate but it appears excavated due to a large brown marginal spot. Male plates convexly rounded on outer margins to blunt apices. Plates as long as pygofer. Styles short, extending about one-fourth the length of plates. Anterior spines composed of two short spurs on each side which are not proximal. Posterior spines thick at base, bifid, cleft more than half way to base, the arms widely separated.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at Colfax, California. Others examined are from Yosemite, Santa Cruz Mts., Escondida, and Quincy California; Idaho City, Idaho; and Grant Teton National Forest, Wyoming.

***Ballana repa* DeLong**

(Figs. 112, 150, 290, and 368)

Ballana repa DeLong, 1937: 122.

Resembling *angula* in form and general appearance but with distinct genitalia. Length: 5 to 5.5 mm.

Crown produced but broadly rounded, twice as wide between eyes at base as median length. Margin thick, rounded to front.

Color.—Yellowish, tinged with green on pronotum, scutellum and forewings.

Genitalia.—Female seventh sternum convexly roundedly produced from base to form a narrow posterior margin about half the width of segment, which is truncate. Male plates a little longer than combined width at base, side margins concave at middle, apices bluntly rounded, not quite reaching posterior spines. Styles short, extending about one-third the length of plates. Anterior spines represented by a plate with an apical and a lateral spur. Posterior spines short, heavy, bifid on apical half, the arms proximal and extending to dorsal pygofer.

Type.—Ball collection, U. S. National Museum.

Remarks.—Described from specimens collected at Yuma, Arizona.

Ballana chelata DeLong

(Figs. 113, 194, 291, and 353)

Ballana chelata DeLong, 1937: 121.Resembling *titusi* in form and appearance but with distinct genitalia. Length: 5 mm.

Crown produced and angled, about one-fifth wider between eyes at base than length at middle, crown bluntly angled with front.

Color.—Crown yellow; pronotum, scutellum and forewings green, veins paler, apex subhyaline.*Genitalia*.—Female seventh sternum rather long, lateral margins strongly convexly rounded to produce outer lobes between which the central third is slightly excavated, the basal margin of excavation slightly convexly rounded. Male plates a little longer than combined basal width, sides almost straight, apices bluntly pointed, not reaching posterior spines. Styles medium in length, extending about one-third the length of plates. Anterior spines short, thick at base, with an apical spur extending caudally and inwardly. Posterior spines heavy, chelate, cleft about to base and widely separated, not reaching median line.*Type*.—DeLong collection.*Remarks*.—Described from specimens collected at Pacific Grove and Muir Woods, California. Other specimens examined are from Napa, Tamalopsis, Santa Cruz Mt., El Portal, Three Rivers, Montare, and Weed California; Missoula, Montana; and Medford, Oregon.*Ballana gerula* (Ball)

(Figs. 62, 208, and 374)

Thamnotettix gerula Ball, 1910: 304.

A narrow species with a pointed head, forewings mostly brown. Length: 5.5 to 6 mm.

Crown produced and sharply angled, almost as long at middle as basal width between eyes.

Color. Crown, pronotum, and scutellum bright yellow. Forewings dark brown to tip of clavus; apical portion smoky.*Genitalia*.—Female seventh sternum with posterior margin broadly excavated on median third about one-fifth the distance to base, the margin of excavated portion slightly convexly rounded. Male plates rather long, apices divergent, bluntly pointed, reaching posterior spines. Styles medium in length, extending to about the middle of plates. Anterior spines short, represented by a spur which curves inwardly. Posterior spines bifid near base, arms widely separated, transverse, reaching median line.*Type*.—Ball collection, U. S. National Museum.*Remarks*.—Described from specimens collected at Colfax, California; and Medford, Oregon. Additional specimens examined are from Mt. Shasta, Santa Rosa, Upper Lake, Davenport, Canyonville, California; and Kerby, Oregon.*Ballana veruta* (Van Duzee)

(Figs. 60 and 231)

Thamnotettix veruta Van Duzee, 1925: 424.

A green species with produced, bluntly pointed head and distinct male genital structures. Length: 5.5 mm.

Crown produced and pointed, more than three-fourths as long at middle as basal width between eyes.

Color.—Crown and scutellum yellow, pronotum and forewings green, tinged with yellow, apical cells of forewings smoky, subhyaline.*Genitalia*.—Male plates long and slender with pointed apices, extending to the posterior spines. Styles medium in length, not extending to middle of plates. Anterior spines represented by two proximal, parallel, short, thick spines directed caudally. Posterior spines bifid, the arms well separated and not reaching median line.*Type*.—California Academy of Science collection.*Remarks*.—Described from specimens collected at Bryson, Bradley, Soboba Springs, San Jacinto, Dixon, and Shasta Co., California.

***Ballana dupla* sp. n.**

(Figs. 45 and 189)

Related to *gerula* but differing from it by the shorter plates with rounded apices, the longer styles, and the shorter arms of the posterior spine. Length: 5 mm.

Crown produced and bluntly angled, about three-fourths as long at middle as basal width between eyes.

Color.—Crown and scutellum yellow, pronotum and forewings greenish yellow.

Genitalia.—Male plates rather short, blunt at apices. Styles long, extending more than two-thirds the length of the plates. Anterior spine composed of a plate with two minute spurs. Posterior spine cleft at base of pygofer dorsal arm; the arms of spine, spread wide, very short.

Holotype male.—Santa Cruz Mt., California, August 13, 1938, R. I. Sailer, University of Kansas collection.

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